University of North Texas
Denton, Texas

Chemistry 331 - Welch Lab Renovation
RFCSP752-21-247760DH

Construction Documents
Project Manual

Proposals due
February 9, 2021

Treanor HL, Inc Project ST0569.2001.00
Jeff Davis, AIA, CDT
Posted January 12, 2021
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SPECIFICATIONS
DRAWINGS
University of North Texas System  
Chemistry 331 - Welch Lab Renovation  
Proposals Due: February 9, 2021 2:00PM  
HUB HSP Due: February 10, 2021 2:00PM  
Public Opening: February 12, 2021 2:00PM  

In accordance with Education Code 51.783, the University of North Texas System (UNTS), subsequently referred to as Owner, is accepting proposals on behalf of the University of North Texas (UNT) 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 (NIGP code 909-25). Sealed proposals for RFCSP752-21-247760DH Chemistry 331 – Welch Lab Renovation 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.

Proposals will be received up to 2:00p.m. CST on February 9, 2021 HUB Sub-contracting Plans must be received by to 2:00p.m. CST on February 10, 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. CST on February 12, 2021.

Teams Meeting - Join on your computer or mobile app
Click here to join the meeting
Or call in (audio only)
+1 940-304-2772,776258730# United States, Denton
Phone Conference ID: 776 258 730#
Find a local number | Reset PIN

Project Description

This project is for the renovation of the Welch Chair Lab Suite (CHEM 331/334) to provide an additional 2630SF of research space. The new renovated space will include additional wet lab space with six (6) fume hoods, dedicated instrumentation space, and a shared student office, all up to modern safety standards. This will allow UNT to increase the amount of high-impact, externally funded research taking place on campuses as well as strengthen and grow the UNT Chemistry Ph.D. program, already one of the top 4 Ph.D.-producing departments on campus (with about 90 Ph.D. students currently enrolled). This will facilitate collaborations on campus from departments such as Materials Science, Physics, and Mechanical Engineering.

Questions

Questions concerning this proposal should be directed to:

denise.harpool@untsystem.edu

Denise Harpool  
Senior Buyer, Procurement  
Business Services Center  
University of North Texas System

All questions must be received no later than 2:00p.m. CST on January 26, 2021. All questions and answers will be posted to the website by 5:00p.m. CST on February 02, 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 UNT System website located at http://www.untsystem.edu/bids. Oral or other written interpretations or clarifications shall be without legal effect.
Pre-Proposal Meeting and Site Visit

The Project site is available for inspection by prospective proposers after a pre-proposal meeting on January 19, 2021 2:00 p.m. by Teams Meeting: Join on your computer or mobile app

Click here to join the meeting
Or call in (audio only)
+1 940-304-2772,952054215#  United States, Denton
Phone Conference ID: 952 054 215#
Find a local number | Reset PIN

There will be UNT employees available to for viewing of the site Chemistry 331 – Welch Lab – 1508 W. Mulberry St. Denton, TX 76201 on January 21 from 9:00 – 11:00 am. (3 sections of 45 minutes) All contractors/vendors must wear a face covering at all times while in the building and on the UNT campus. As will all UNT/UNT System employees, per State and University requirements. No more than eight (8) vendors may attend per visit, contact denise.harpool@untsystem.edu to schedule.

Bid Documents

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

Online - Proposers can view bid documents at Electronic State Business Daily (http://esbd.cpa.state.tx.us/) or at the UNT System website (http://www.untsystem.edu/bids).

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 on February 10, 2021 before 2:00p.m. CST. Only one (1) hard copy of the HUB plan is required (separate from) your response.

Questions regarding the completion of the HUB Subcontracting Plan should be directed to Aurika Weaver-White 940-369-5580 or Greg Obar at 940-369-5647.

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 and on behalf of the University of North Texas (UNT), 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. **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 via Teams:

   January 19, 2021 at 2:00 p.m. -University of North Texas System
   Via Teams Meeting - Join on your computer or mobile app
   Click here to join the meeting
   Or call in (audio only)
   +1 940-304-2772, 952054215#
   United States, Denton
   Phone Conference ID: 952 054 215#
   Find a local number | Reset PIN

   There will be UNT employees available to for viewing of the site Chemistry 331 – Welch Lab – 1508 W. Mulberry St. Denton, TX 76201 on January 21 from 9:00 – 11:00 am (3 sections of 45 minutes). All contractors/vendors must wear a face covering at all times while in the building and on the UNT campus. As will all UNT/UNT System employees, per State and University requirements. No more than eight (8) vendors may attend per visit, contact denise.harpool@untsystem.edu to schedule.

2. **PROJECT PROPOSED SCHEDULE**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event Description</th>
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</thead>
<tbody>
<tr>
<td>Jan 12, 2021</td>
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<td>Issue RFCSP</td>
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<tr>
<td>Jan 19, 2021</td>
<td>2:00 p.m.</td>
<td>Pre-Proposal Conference</td>
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<tr>
<td>Jan 21, 2021</td>
<td>9:00-11:00a.m.</td>
<td>Site Visit (3 sections of 45 minutes)</td>
</tr>
<tr>
<td>Jan 26, 2021</td>
<td>2:00 p.m.</td>
<td>Deadline for Submission of Questions</td>
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<tr>
<td>Feb 02, 2021</td>
<td>5:00 p.m.</td>
<td>Responses to Questions Post on Website</td>
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<tr>
<td>Feb 09, 2021</td>
<td>2:00 p.m.</td>
<td>Deadline for Submission of Proposal</td>
</tr>
<tr>
<td>Feb 10, 2021</td>
<td>2:00 p.m.</td>
<td>Deadline for Submission of HUB</td>
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<td>Feb 12, 2021</td>
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<td>Public Opening – Virtual</td>
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<tr>
<td>March 2021</td>
<td></td>
<td>Formal Contract Award Notification</td>
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<tr>
<td>April 2021</td>
<td></td>
<td>Anticipated Notice to Proceed</td>
</tr>
<tr>
<td>August 2021</td>
<td></td>
<td>Substantial Completion</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*.

   3.2 **Unit Prices**

   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. Respondents may respond with less than the total number of items. 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. Responses on brands 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, items offered 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. Manufacturer's standard warranty shall apply unless otherwise stated in the Response.

F. Catalogs, brand names or manufacturer's references are descriptive only, and indicate type and quality desired. Responses on brands 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.

G. Unless otherwise specified, items offered shall be new and unused.

H. 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.

I. 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.

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K. Unless otherwise specified, items offered shall be new and unused.

L. 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.

M. Catalogs, brand names or manufacturer’s references are descriptive only, and indicate type and quality desired. Responses on brands 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.

N. Catalogs, brand names or manufacturer's references are descriptive only, and indicate type and quality desired. Responses on brands 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.

O. Unless otherwise specified, items offered shall be new and unused.

P. 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.

Q. 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.

R. Manufacturer's standard warranty shall apply unless otherwise stated in the Response.

S. Delivery

i. Show number of days required to place material at the Owner’s designated location under normal conditions. Failure to state delivery time obligates respondent to deliver in fourteen (14) calendar days. Unrealistic delivery promises may cause offer to be disregarded.

ii. If delay is foreseen, respondent shall give written notice to the Owner. Vendor must keep the Owner advised at all times of status of order. Default in promised delivery (without accepted reasons) or failure to meet specifications authorizes the Owner to purchase supplies elsewhere and charge full increase, if any, in cost and handling to defaulting vendor.

iii. No substitutions permitted without written approval of UNTS Business Service Center Purchasing.

iv. Delivery shall be made during normal working hours only, unless prior approval has been obtained from the Owner.

T. Inspection and Tests

All goods will be subject to inspection and test by the Owner. Authorized Owner personnel shall have access to supplier's place of business for the purpose of inspecting merchandise. Tests shall be performed on samples submitted with the response or on samples taken from regular shipment. All costs shall be borne by the respondent in the event products tested fail to meet or exceed all conditions and requirements in this Solicitation. Goods delivered and rejected in whole or in part may, at the Owner’s option, be returned to Respondent or held for disposition at Respondent's expense. Latent defects may result in revocation of acceptance.

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. SUBMISSION OF PROPOSALS

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 virus free flash or thumb drive (Please check this drive to verify it is in good working condition before sending in your submission packet). 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. CST, February 9, 2021. Proposals received after the date and hour previously stated will not receive consideration. (HUB HSP due no later than 2:00p.m. CST February 10, 2021.)

TO: Denise Harpool
Senior Buyer
University of North Texas System
Business Service Center
Woodhill Square
1112 Dallas Drive, Suite 4000
Denton, Texas 76205

Proposals will be received until the date and time established for receipt, then opened. The names of the respondents who submitted proposals will be made public. A virtual public opening shall be held on February 12, 2021 promptly at 2:00p.m. Via Teams meeting – Join on your computer or mobile app

Click here to join the meeting
Or call in (audio only)
+1 940-304-2772, 776258730# United States, Denton
Phone Conference ID: 776 258 730#
Find a local number | Reset PIN

4.1 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 Agreement.

Any questions or concerns regarding this Request for Proposals shall be directed to:

Denise Harpool
Senior Buyer, Procurement
University of North Texas System

Please submit solicitation questions to:
denise.harpool@untsystem.edu

All questions must be received no later than January 26, 2021 at 2:00p.m. All questions and answers will be posted to the website by 5:00pm February 02, 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 in electronically by addendum (amendment) and posted at http://www.untsystem.edu/bids and http://esbd.cpa.state.tx.us/.

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.
4.2 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.

4.3 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.

4.4 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.

4.5 Insurance and Bonds

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

4.6 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.

4.7 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.

4.8 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.
4.9 Assignment

The potential agreement with Contractor resulting from this RFCSP 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.

4.10 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).

4.11 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.

4.12 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.

4.13 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.

4.14 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.

4.15 Section Headings

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.

4.16 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.

4.17 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.

4.18 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.

4.19 Pursuant to Section 231.006 of the Family Code, response must include names and social security numbers of each person with at least 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.

4.20 **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 Purchasing.
5. EVALUATION

5.1 The successful offer will be the offer that is submitted in response to this Proposal by the Submittal Deadline and is the most advantageous 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. Specifically, lab renovations and projects in occupied buildings.
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. Specifically, Higher Education examples.
F. The proposer’s proposed project schedule and the demonstrated ability to have met expedited schedules on similar projects.
G. The responsibility and reputation of the proposer, including claims and litigation experiences.
H. The proposer’s safety record.
I. The sufficiency of the proposer’s financial resources.
J. Quality and completeness of RFCSP submittal

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 at http://bsc.untsystem.edu/content/bid-inquiry.

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 (CMBL): The Owner utilizes the Texas Comptroller of Public Accounts CMBL for HUB. The CMBL is located at http://www.window.state.tx.us/procurement/ . Non-HUB respondents are identified from various sources including the CMBL.

C. Questions regarding completing the HSP should be directed to Greg Obar or Aurika Waever-White, HUB Program UNT System, at 940-369-5647. 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
Proposal of: ________________________________

(Company Name)

The University of North Texas System (UNTS), on behalf of the University of North Texas (UNT), subsequently referred to as the Owner, is accepting sealed 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). This RFCSP provides sufficient information for interested parties to prepare and submit proposals for consideration by the Owner.

UNTS is accepting sealed proposals no later than 2:00 p.m. CST on February 09, 2021. Proposals received after the date and hour previously stated will not receive consideration. The HUB Sub-Contracting Plan is due no later than 2:00 p.m. CST on February 10, 2021. Failure to submit the HUB plan will disqualify your proposal.

The scope of work of this RFCSP is General Construction for Chemistry 331- Welch Lab Renovation. 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.

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

TO: Denise Harpool
    Senior Buyer, Procurement UNTS
    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 Proposal, the Proposer hereby certifies that it has carefully examined the Contract Document entitled:

Chemistry 331- Welch Lab Renovation

Prepared by: Treanor HL

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:

$
ISSUED DATE:
January 12, 2021

ALTERNATE BIDS

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<tbody>
<tr>
<td>1.</td>
<td>No Alternates at this time</td>
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</table>

PAYMENT TERMS

UNTS 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 Respondent if Respondent is determined to be more than thirty (30) days delinquent for Child Support.

b. Successful Respondent 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 Respondent 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. Respondent 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 Contractor 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: ______


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.

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 RFCSP 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 RFCSP. (ref. Section 2155.004, Texas Government Code).

13. Respondent represents and warrants that all articles and services quoted in response to this RFCSP 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](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 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)
ITEMS 1 THROUGH 6 TO BE SUBMITTED WITH PROPOSAL

Proposer’s Name:__________________________________________________________

Address:________________________________________________________________

City, State, Zip:___________________________________________________________

Telephone No.:_________________________ Fax No. _____________________________

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>
</tr>
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<tbody>
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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. Total number and dollar amount of contracts currently in progress:

Number ___________ $___________________________

D. Largest contract currently in-process: ________________________________
Anticipated date of completion: ________________________________

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

Year _____ $___________________________
_______ $___________________________
_______ $___________________________
_______ $___________________________
_______ $___________________________
F. Has your organization had any claims and/or litigations in the last 5 years?
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

G. If yes, list 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 years, as obtained from your insurance agent.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>EMR</th>
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B. Complete matrix for the three 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>
<th>Total Injury &amp; illness rate from OSHA 300 log</th>
</tr>
</thead>
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</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
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  ☐ No
   Tool box safety meetings  ☐ Yes  ☐ No
   First aid procedures  ☐ Yes  ☐ No
   Accident investigation  ☐ Yes  ☐ No
   Fire protection  ☐ Yes  ☐ No
   New worker’s orientation  ☐ Yes  ☐ No

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 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. ________________

       iv. Organization: __________________________

           Agent: __________________________

           Name of Contract: ________________ Telephone No. ________________

   E. Bank Reference (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.____________

6. CSP WRITTEN NARRATIVE RESPONSE

Please provide a written proposal (maximum 15 pages) which should include the following information:

A. List all major projects of your organization has in-progress.
   • Name of the project (no project photos)
   • Location
   • Contract amount
   • Percent complete
   • Project completion date

B. List three (3) major projects of similar scope your organization has completed in the last five (5) years and include the following information:
   • Name of the project
   • Location
   • Maximum of 3 project photos
   • Brief project description
   • Contract amount
   • Current percent complete
   • Anticipated or actual project completion date
   • Original completion date vs. anticipated/actual completion date
   • Owner reference contact with address and telephone number
   • Architect reference contact with address and telephone number

C. List key team members proposed for the project and include the following information for each KEY team member:
   • Name, title and role
   • Resume
   • Number of years experience
   • Number of years experience in that role
   • Amount of time committed to the project
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 Contractor 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.

7.2.3 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.

7.2.4 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.

7.2.5 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.

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

7.2.6.1 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:
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 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: ________________________________
(signature)

[Authorized Signatory Name]
[Authorized Signatory Title]

Date: _______________________________

CONTRACTOR:

{FIRM NAME}

By: ________________________________
(signature)

(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:

<table>
<thead>
<tr>
<th>Sheet Number</th>
<th>Title</th>
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ADDENDA

<table>
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<th>Number</th>
<th>Title</th>
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</table>
PAYMENT BOND

Surety Bond No.

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)

(Signature)

(Typed Name and Title)

(Texas Vendor ID No.)

(Address)

(City, State, Zip)

(Telephone)
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 anyway 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:

(Signature)

(Principal)

(Signature)

(Typed Name and Title)

(Typed Name and Title)

(SEAL)

ATTEST:

(Signature)

(Surety)

(Signature)

(Typed Name and Title)

(Typed Name and Title)

(SEAL)

Surety’s Texas Local Recording Agent or Resident 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)

Surety’s Home Office Agent or Servicing Agent:

(Name)

(Name)

(Title)

(Title)

(Address)

(Address)

(City, State, Zip)

(City, State, Zip)

(Telephone)

(Telephone)
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(6)(1)(3)(10), 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
   Bid Open Date: *(mm/dd/yyyy)*

c. Requisition #: ________________
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 §20.202, 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:

(Percentages should total 100%.)

(Note: If you have more than fifteen subcontracting opportunities, a continuation sheet is available online at https://wpp.comptroller.texas.gov/purchasing/vendorhub/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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<thead>
<tr>
<th>Item #</th>
<th>Subcontracting Opportunity Description</th>
<th>HUBs</th>
<th>Non-HUBs</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Percentage of the contract expected to be subcontracted to HUBs with which you do not have a continuing contract in place for more than five (5) years.</td>
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Aggregate percentages of the contract expected to be subcontracted:

*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 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.

<table>
<thead>
<tr>
<th>Signature</th>
<th>Printed Name</th>
<th>Title</th>
<th>Date</th>
</tr>
</thead>
</table>

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/pn/mbiCmbSearch/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)

Enter your company's name here: ___________________________ Requisition #: ___________________________

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 photocopy this page or download the form at https://www.comptroller.texas.gov/purchasing/docs/hub-forms/hub-sbcom-plan-gfe-achm-b.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-4, 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.

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.

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 Bidder List (CMBL) - Historically Underutilized Business (HUB) Directory Search located at http://mycxp.cpa.state.tx.us/txasassembly/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>
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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.

d. List 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.

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<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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Page 1 of 2
(Attachment B)
**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 this Attachment 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://myopia.cpa.state.tx.us/tpasscmblsearch/index.jsp](http://myopia.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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**c.** 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):

**REMEMBER:** 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.
HUB Subcontracting Opportunity Notification Form

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>
</tr>
</thead>
<tbody>
<tr>
<td>Point-of-Contact:</td>
<td>Phone #:</td>
</tr>
<tr>
<td>E-mail Address:</td>
<td>Fax #:</td>
</tr>
</tbody>
</table>

SECTION B: CONTRACTING STATE AGENCY AND REQUISITION INFORMATION

<table>
<thead>
<tr>
<th>Agency Name:</th>
<th>Point-of-Contact:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisition #:</td>
<td>Phone #:</td>
</tr>
<tr>
<td>Bid Open Date:</td>
<td>(mm/dd/yyyy)</td>
</tr>
</tbody>
</table>

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 ____________________ Central Time Date (mm/dd/yyyy).

   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
UNIFORM GENERAL CONDITIONS
FOR CONSTRUCTION AND DESIGN CONTRACTS
2019
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  2.2.3 Complaints of Violations ............................................................................................... 8
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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.
1.51 “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.

1.52 “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.

1.53 “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.

1.54 “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.

1.55 “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.

1.56 “Total Float” means the total number of days an activity on the longest path can be delayed without delaying the Substantial Completion Date.

1.57 “Unit Price Work” means the Work or a portion of the Work, paid for based on incremental units of measurement.

1.58 “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.

1.59 “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, RFI, 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/.)
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, 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>
</tr>
</thead>
<tbody>
<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>
</tr>
<tr>
<td>$3,000,000 up to &lt; $5,000,000</td>
<td>$5,000,000</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>$5,000,000 or greater</td>
<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 ensure 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 Per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>From To</td>
<td></td>
</tr>
<tr>
<td>&lt; $1,000,000</td>
<td>$250</td>
</tr>
<tr>
<td>$1,000,000 &lt; $25,000,000</td>
<td>$1,000</td>
</tr>
<tr>
<td>$25,000,000 &lt; $50,000,000</td>
<td>$2,500</td>
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<tr>
<td>$50,000,000 &lt; $75,000,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>$75,000,000 &lt; $100,000,000</td>
<td>$7,500</td>
</tr>
<tr>
<td>&gt; $100,000,000</td>
<td>$10,000</td>
</tr>
</tbody>
</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.
University of North Texas
Chemistry Welch Chair Lab Renovation

December 18, 2020

PROJECT MANUAL
ISSUED FOR CONSTRUCTION
TECHNICAL SPECIFICATIONS PROFESSIONAL SEAL – PLUMBING

Project: UNT Chemistry Welch Chair Lab Renovation

The following Technical Specifications have been prepared under the direction of the following professional. The various parts to which their individual responsibilities apply are limited those identified above their seal:

DIVISION 02 – EXISTING CONDITIONS
Section 02 1449 Selective Demolition

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES
Section 06 1053 Misc Rough Carpentry

DIVISION 07 – THERMAL AND MOISTURE PROTECTION
Section 07 8413 Penetration Firestopping
Section 07 8443 Joint Firestopping
Section 07 9200 Joint Sealants
Section 07 9219 Acoustical Joint Sealants

DIVISION 08 – OPENINGS
Section 08 1213 Hollow Metal Frames
Section 08 1416 Flush Wood Doors
Section 08 7100 Door Hardware
Section 08 8000 Glazing

DIVISION 09 – FINISHES
Section 09 2216 Non-Structural Metal Framing
Section 09 2900 Gypsum Board
Section 09 5113 Acoustical Panel Ceilings
Section 09 6513 Resilient Base and Accessories
Section 09 9123 Interior Painting

DIVISION 10 – SPECIALTIES
Section 10 2600 Wall and Door Protection
Section 10 4413 Fire Protection Cabinets

DIVISION 11 – EQUIPMENT
Section 11 5313 Laboratory Fume Hoods

DIVISION 12 – FURNISHINGS
Section 12 3553 Wood Laboratory Casework
TECHNICAL SPECIFICATIONS PROFESSIONAL SEAL – ELECTRICAL

Project: UNT Chemistry Welch Chair Lab Renovation

The following Technical Specifications have been prepared under the direction of the following professional. The various parts to which their individual responsibilities apply are limited those identified above their seal:

DIVISION 26 – ELECTRICAL
Section 26 0000 ....... Electrical General Provisions
Section 26 0001 ....... Electrical Demolition
Section 26 0519 ....... Insulated Conductors
Section 26 0526 ....... Grounding
Section 26 0529 ....... Metal Framing and Supports
Section 26 0533 ....... Raceways
Section 26 0537 ....... Boxes
Section 26 0553 ....... Electrical Identification
Section 26 2416 ....... Panelboards – Distribution and Branch Circuit
Section 26 2726 ....... Wiring Devices
Section 26 2813 ....... Fuses – 600 Volt and Below
Section 26 2816 ....... Enclosed Safety Switches
Section 26 5100 ....... Interior and Exterior Lighting
Section 26 5110 ....... Lighting Control System
Section 28 3100 ....... Fire Alarm System

Shah Smith & Associates
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Houston, Texas 77042
TECHNICAL SPECIFICATIONS PROFESSIONAL SEAL – MECHANICAL

Project: UNT Chemistry Welch Chair Lab Renovation

The following Technical Specifications have been prepared under the direction of the following professional. The various parts to which their individual responsibilities apply are limited those identified above their seal:

DIVISION 23 – HEATING VENTILATION AND AIR CONDITIONING (HVAC)
Section 23 0010 ...... Mechanical General Provisions
Section 23 0020 ...... Mechanical Demolition
Section 23 0523 ...... General Duty Valves for HVAC Piping
Section 23 0553 ...... Identification for HVAC Piping and Equipment
Section 23 0700 ...... Insulation General
Section 23 0713 ...... External Duct Insulation
Section 23 0719 ...... Piping Insulation
Section 23 0913 ...... Laboratory Control Systems
Section 23 2113 ...... Hydronic Piping and Fittings
Section 23 3113 ...... Ductwork
Section 23 3300 ...... Air Duct Accessories
Section 23 3713 ...... Air Devices

Shah Smith & Associates
8445 Freeport Parkway, Suite 500
Irving, TX 75063
TECHNICAL SPECIFICATIONS PROFESSIONAL SEAL – PLUMBING

Project: UNT Chemistry Welch Chair Lab Renovation

The following Technical Specifications have been prepared under the direction of the following professional. The various parts to which their individual responsibilities apply are limited those identified above their seal:

DIVISION 21 – FIRE PROTECTION
Section 21 0553 ........ Identification for Fire-Suppression Piping and Equipment
Section 21 1313 ........ Fire Protection Sprinkler System

DIVISION 22 – PLUMBING
Section 22 0500 ........ Common Work Results for Plumbing
Section 22 0526 ........ Pipe and Pipe Fittings
Section 22 0529 ........ Hangers and Support for Plumbing
Section 22 0553 ........ Identification for Plumbing Piping and Equipment
Section 22 0719 ........ Plumbing Piping Insulation
Section 22 1116 ........ Domestic Water Piping Systems
Section 22 1119 ........ Domestic Water Piping Specialties
Section 22 1316 ........ Sanitary Waste and Vent Piping
Section 22 1319 ........ Sanitary Waste Piping Specialties
Section 22 4000 ........ Plumbing Fixtures
Section 22 6119 ........ Compressed Air Systems
Section 22 6653 ........ Laboratory Chemical Waste and Vent Piping
Section 22 6719.16 . Reverse Osmosis (RO) Water Piping

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DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES
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DIVISION 07 - THERMAL AND MOISTURE PROTECTION
07 8413 - Penetration Firestopping
07 8443 - Joint Firestopping
07 9200 - Joint Sealants
07 9219 - Acoustical Joint Sealants

DIVISION 08 - OPENINGS
08 1213 - Hollow Metal Frames
08 1416 - Flush Wood Doors
08 7100 - Door Hardware
08 8000 - Glazing

DIVISION 09 - FINISHES
09 2216 - Non-Structural Metal Framing
09 2900 - Gypsum Board
09 5113 - Acoustical Panel Ceilings
09 6513 - Resilient Base and Accessories
09 9123 - Interior Painting

DIVISION 10 - SPECIALTIES
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- 23 0913 - Laboratory Control Systems
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- 23 3113 - Ductwork
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- 23 3713 - Diffusers, Registers, and Grilles

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26 2816  -  Enclosed Safety Switches
26 5100  -  Interior and Exterior Lighting
26 5110  -  Lighting Control Systems

DIVISION 28  -  ELECTRONIC SAFETY AND SECURITY
28 3100  -  Fire Alarm System
SECTION 02 4119
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.

1.2 DEFINITIONS
A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
C. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP
A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PREINSTALLATION MEETINGS
A. Predemolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS
A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 “Photographic Documentation.” Submit before Work begins.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
   1. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   2. Cover and protect furniture, furnishings, and equipment that have not been removed.

3.2 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   6. Dispose of demolished items and materials promptly

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3.4 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION
SECTION 06 1053
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. Wood blocking.
   2. Plywood backing panels.

1.3 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.

1.4 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. 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.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS
A. General: Where fire-retardant-treated materials are indicated, materials shall comply with
   requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-
test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

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 E84, 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.

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 qualified testing agency.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

B. Dimension Lumber Items: Construction or No. 2 grade lumber.

C. Concealed Boards: 19 percent maximum moisture content.

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.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 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. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. 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.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   2. 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.
   3. ICC-ES evaluation report for fastener.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

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.

END OF SECTION
SECTION 07 8413
PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
   2. Penetrations in smoke barriers.

B. Related Requirements:
   1. Section 07 8443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

   1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.
1.5 CLOSEOUT SUBMITTALS
   A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 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 its "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS
   A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
   B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION
   A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
   B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Fire-Test-Response Characteristics:
      1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
      2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
         a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
            1) UL in its "Fire Resistance Directory."
2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hilti, Inc.
   b. NUCO Inc.
   d. Specified Technologies, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.
2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.


2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, 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:
Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

#### B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

### 3.3 INSTALLATION

#### A. General:
Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

#### B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

#### C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
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. Wall Identification:
Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. 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:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner and Fire Marshal will perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION
SECTION 07 8443

JOINT FIRESTOPPING

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 in smoke barriers.
B. Related Requirements:
   1. Section 07 8413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
   2. Section 09 2216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.
1.5 CLOSEOUT SUBMITTALS
   A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 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."

1.7 PROJECT CONDITIONS
   A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
   B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION
   A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
   B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Fire-Test-Response Characteristics:
      1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
      2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
         a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
            1) UL in its "Fire Resistance Directory."
2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping 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 joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
   1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.
   1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

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: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive 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 elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping 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.
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 elastomeric 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 elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric 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. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping 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. Owner and Fire Marshal will perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.
3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping 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 joint firestopping 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.

END OF SECTION
SECTION 07 9200

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. Urethane joint sealants.
   2. Latex joint sealants.

1.3 PREINSTALLATION MEETINGS

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.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

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 C1021 to conduct the testing indicated.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When joint substrates are wet.
2. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
3. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 LATEX JOINT SEALANTS
   A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.3 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.
   B. 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.

2.4 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. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

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.

B. 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 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 C1193 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.

D. 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.

E. 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 C1193 unless otherwise indicated.
   a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
3.4 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.

3.5 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.

3.6 JOINT-SEALANT SCHEDULE
   A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not
   subject to significant movement – JS1
      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.
         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
SECTION 07 9219

ACOUSTICAL 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 acoustical joint sealants.
   B. Related Requirements:
      1. Section 07 9200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS
   A. Product Data: For each acoustical joint sealant.

1.4 INFORMATIONAL SUBMITTALS
   A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
   B. Sample Warranties: For special warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.

2.2 ACOUSTICAL JOINT SEALANTS
   A. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.
2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical 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 acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. 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 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 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 acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical 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 acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

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. Interior standard steel frames.

B. Related Requirements:
   1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

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.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each frame type.
   2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   3. Locations of reinforcement and preparations for hardware.
4. Details of each different wall opening condition.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.

C. Product Schedule: For hollow-metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated hollow-metal frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal frames 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 frames 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door: ASSA ABLOY,
2. Curries Company: ASSA ABLOY,
3. Custom Metal Products,
4. Republic Doors and Frames,
5. Steelcraft; an Allegion brand,
6. West Central Manufacturing, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: 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.

2. Oversize Fire-Rated Frames: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that frames comply with standard construction requirements for tested and labeled fire-rated assemblies except for size.

2.3 STANDARD STEEL FRAMES

A. Construct hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Interior Frames: SDI A250.8. [At locations indicated in the Door and Frame Schedule] <Insert locations>.

1. Materials: [Uncoated] [Metallic-coated] steel sheet, minimum thickness of 0.053 inch.
2. Construction: Full profile welded.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

D. 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.
2.6 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.

2.7 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with SDI A250.11.

B. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
1. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
2. Install frames with removable stops located on secure side of opening.

C. Fire-Rated Openings: Install frames according to NFPA 80.

D. Floor Anchors: Secure with postinstalled expansion anchors.
   1. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

E. Solidly pack mineral-fiber insulation inside frames.

F. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

G. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

A. 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.

END OF SECTION
SECTION 08 1416
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 flush wood doors with plastic-laminate-faces.
   2. Factory fitting flush wood doors to frames and factory machining for hardware.
B. Related Requirements:
   1. Section 08 8000 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product, including the following:
   1. Door core materials and construction.
   2. Door edge construction
   3. Door face type and characteristics.
   4. Door frame construction.
B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door;
   construction details not covered in Product Data; and the following:
   1. Door schedule indicating door and frame location, type, size, fire protection rating, and
      swing.
   2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing
      thicknesses.
   3. Details of frame for each frame type, including dimensions and profile.
   4. Dimensions and locations of blocking for hardware attachment.
   5. Dimensions and locations of mortises and holes for hardware.
   6. Clearances and undercuts.
C. Samples for Initial Selection: For plastic-laminate door faces.
D. Samples for Verification:
   1. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.
1.4 INFORMATIONAL SUBMITTALS
   A. Field quality-control reports.
   B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS
   A. Special warranties.
   B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Comply with requirements of referenced standard and manufacturer's written instructions.
   B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.
   C. Mark each door on 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 temperature and relative humidity at levels designed for building occupants for the 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. Delamination of veneer.
         b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
         c. 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.
2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252.

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.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.3 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ASSA ABLOY.
   b. Masonite Architectural.
   c. Oshkosh Door Company.
   d. Poncraft Door Company.
   e. VT Industries Inc.

2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.

3. ANSI/WDMA I.S. 1A Grade: Custom.

4. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HSH.

5. Colors, Patterns, and Finishes: Match Existing – Nevamar Bethany Beige – Textured S2069T.


   a. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

7. Core for Non-Fire-Rated Doors:
   a. ANSI A208.1, Grade LD-1 particleboard.
      1) Blocking: Provide wood blocking in particleboard-core doors as follows:
         a) 5-inch top-rail blocking, in doors indicated to have closers.
         b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
      2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."
   b. Glued wood stave.
   c. WDMA I.S. 10 structural composite lumber.
      1) Screw Withdrawal, Door Face: 550 lbf.
      2) Screw Withdrawal, Vertical Door Edge: 550 lbf.
   d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

8. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
   a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as follows:
      1) 5-inch top-rail blocking.
      2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
      3) 5-inch midrail blocking, in doors indicated to have exit devices.

9. Construction: Five plies, hot-pressed or cold-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces and crossbands are applied.

2.4 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.
B. Factory machine doors for hardware that is not surface applied.

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 08 8000 "Glazing."

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 Section 087100 "Door Hardware."
   B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   C. Install frames level, plumb, true, and straight.
      1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
      2. Anchor frames to anchors or blocking built in or directly attached to substrates.
         a. Secure with countersunk, concealed fasteners and blind nailing.
      3. Install fire-rated doors and frames in accordance with NFPA 80.
      4. Install smoke- and draft-control doors in accordance with NFPA 105.
   D. Job-Fitted Doors:
   E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 FIELD QUALITY CONTROL
   A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 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
SECTION 08 7100

DOOR HARDWARE

GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:
   a. Swinging doors.

2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

3. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

A. UL - Underwriters Laboratories
1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute
   1. Sequence and Format for the Hardware Schedule
   2. Recommended Locations for Builders Hardware
   3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute
   1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

A. General:
   1. Submit in accordance with Conditions of Contract and Division 01 requirements.
   2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
   3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:
   1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
   2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
      a. Wiring Diagrams: For power, signal, and control wiring and including:
         1) Details of interface of electrified door hardware and building safety and security systems.
         2) Schematic diagram of systems that interface with electrified door hardware.
         3) Point-to-point wiring.
         4) Risers.
   3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
      a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

a. Door Index; include door number, heading number, and Architects hardware set number.
b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
c. Quantity, type, style, function, size, and finish of each hardware item.
d. Name and manufacturer of each item.
e. Fastenings and other pertinent information.
f. Location of each hardware set cross-referenced to indications on Drawings.
g. Explanation of all abbreviations, symbols, and codes contained in schedule.
h. Mounting locations for hardware.
i. Door and frame sizes and materials.
j. Name and phone number for local manufacturer's representative for each product.
k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.

1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.

1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:
1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product data for electrified door hardware:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Certificates of Compliance:
   a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
   b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.
   c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in “QUALITY ASSURANCE” article, herein.
4. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Factory order acknowledgement numbers (for warranty and service)
   d. Name, address, and phone number of local representative for each manufacturer.
   e. Parts list for each product.
   f. Final approved hardware schedule, edited to reflect conditions as-installed.
   g. Final keying schedule
   h. Copies of floor plans with keying nomenclature
   i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
   j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
   
a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

B. Architectural Hardware Consultant Qualifications: Person 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 and meets these requirements:
   
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.
5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

D. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.

G. Keying Conference
   
1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
   
a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   b. Preliminary key system schematic diagram.
   c. Requirements for key control system.
   d. Requirements for access control.
   e. Address for delivery of keys.

H. Pre-installation Conference
   
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

I. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys to Owner by registered mail or overnight package service.

1.07 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.08 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.
   a. Closers:
      1) Mechanical: LCN 4000 series, 30 years
      2) Electrified: 2 years.
   b. Automatic Operators: LCN, 2 years
   c. Exit Devices:
      1) Mechanical: 3 years.
      2) Electrified: 1 year.
   d. Locksets:
      1) Mechanical: Schlage ND series, 10 years
      2) Electrified: 1 year.
   e. Continuous Hinges: Lifetime warranty.
   f. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PRODUCTS

2.01 MANUFACTURERS

A. NO SUB: The Owner requires use of certain products for their unique characteristics and project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected
to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect’s approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.

3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.

4. Install hardware with fasteners provided by hardware manufacturer.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.

2. Use materials which match materials of adjacent modified areas.

3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:
1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.
4. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

B. Requirements:
1. Provide hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high
4. 2 inches or thicker doors:
   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins
8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.

10. Provide mortar guard for each electrified hinge specified.

11. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.04 EMERGENCY HARDWARE

A. Double Lipped Strike

1. Manufacturers:
   a. Scheduled Manufacturer: Ives.

2. Provide double lip strike offset-hung to allow door to swing open in opposite direction unless detailed otherwise. Size for specific frame depth. Coordinate special latchbolt-hole location and special template, as required, to operate with mortise lock being used as specified.

3. Provide compatible emergency stop/release as recommended by manufacturer of double lip strike or engineered to operate with double lip strike.

B. Emergency Stop/Release

1. Manufacturers:
   a. Scheduled Manufacturer: Ives.

2. Provide emergency stop/release for doors with double lip strikes offset-hung to allow door to swing open in opposite direction unless detailed otherwise.

2.05 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

2. Acceptable Manufacturers: BEST

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
   a. Lever Design: Schlage RHO.
   b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.06 EXIT DEVICES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: Von Duprin 98/35A Series – No Substitutions

B. Requirements:
   1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
   2. Cylinders: Refer to “KEYING” article, herein.
   3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
   4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
   5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
   6. Provide flush end caps for exit devices.
   7. Provide exit devices with manufacturer’s approved strikes.
   8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
   9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
   10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
   11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
   12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
   13. Provide electrified options as scheduled.
   14. QM 98/99 Rim Exit Devices: provide devices with damper controlled re-latching to reduce operational noise. Where lever trim is specified, provide damper controlled lever return.
   15. Top latch mounting: double or single tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
   16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
a. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.07 CYLINDERS: MATCH OWNERS KEY SYSTEM

A. Manufacturers:
   1. Scheduled Manufacturer: BEST SFIC core

B. Requirements:
   1. Provide permanent interchangeable cylinders/cores to match Owner’s existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer’s series as indicated. Refer to “KEYING” article, herein.

C. Construction Keying:
   1. Temporary Construction Cylinder Keying.
      a. Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
         1) Split Key or Lost Ball Construction Keying System.
         2) 3 construction control keys, and extractor tools or keys as required to void construction keying.
         3) 12 construction change (day) keys.
      b. Owner or Owner’s Representative will void operation of temporary construction keys.

   2. Replaceable Construction Cores.
      a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
         1) 3 construction control keys
         2) 12 construction change (day) keys.
      b. Owner or Owner’s Representative will replace temporary construction cores with permanent cores.

2.08 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. For factory registered existing system: Provide cylinders/cores keyed into Owner’s existing factory registered keying system.

C. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
D. For non-factory existing system: Provide cylinders/cores keyed into Owner’s existing keying system managed by Owner’s locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:

1. Firm Name:
2. Contact Person:
3. Telephone:

E. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
   a. Master Keying system as directed by the Owner.
   b. No Master Keying: Cylinders/cores only operated by change (day) keys.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.

3. Provide keys with the following features:
   a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
   b. Patent Protection: Keys and blanks protected by one or more utility patent(s).

4. Identification:
   a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication “Keying Systems and Nomenclature” for identification. Do not provide blind code marks with actual key cuts.
   b. Identification stamping provisions must be approved by the Architect and Owner.
   c. Stamp cylinders/cores and keys with Owner’s unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with “DO NOT DUPLICATE” along with the “PATENTED” or patent number to enforce the patent protection.
   d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
   e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.
   a. Change (Day) Keys: 3 per cylinder/core.
   b. SFIC: Permanent Control Keys: 3.

2.09 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series – No Substitutions

B. Requirements:
1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.10 PROTECTION PLATES

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.

B. Requirements:
   1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
   2. Sizes of plates:
      a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
      b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
      c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.11 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturers: Glynn-Johnson.
B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.12 DOOR STOP AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.13 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:


B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:
   a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
   b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.14 SILENCERS

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.

B. Requirements:
   1. Provide "push-in" type silencers for hollow metal or wood frames.
   2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
   3. Omit where gasketing is specified.

2.15 FINISHES

A. Finish: BHMA 626/652 (US26D); except:
   1. Hinges at Exterior Doors: BHMA 630 (US32D)
   2. Continuous Hinges: BHMA 630 (US32D)
   3. Continuous Hinges: BHMA 628 (US28)
   5. Protection Plates: BHMA 630 (US32D)
   6. Overhead Stops and Holders: BHMA 630 (US32D)
   7. Door Closers: Powder Coat to Match
   8. Wall Stops: BHMA 630 (US32D)
   9. Latch Protectors: BHMA 630 (US32D)
   10. Weatherstripping: Clear Anodized Aluminum
   11. Thresholds: Mill Finish Aluminum

B. Finish: BHMA 625/651 (US26); except:
   1. Hinges at Exterior Doors: BHMA 629 (US32)
   2. Continuous Hinges: BHMA 630 (US32D)
   3. Continuous Hinges: BHMA 628 (US28)
   5. Protection Plates: BHMA 629 (US32)
   6. Overhead Stops and Holders: BHMA 629 (US32)
   7. Door Closers: Powder Coat to Match
   8. Wall Stops: BHMA 629 (US32)
   9. Latch Protectors: BHMA 630 (US32D)
   10. Weatherstripping: Clear Anodized Aluminum
   11. Thresholds: Mill Finish Aluminum

C. Finish: BHMA 612/639 (US10); except:
   1. Continuous Hinges: BHMA 630 (US32D)
   2. Continuous Hinges: BHMA 709 (US10)
3. Door Closers: Powder Coat to Match
4. Latch Protectors: BHMA 630 (US32D)
5. Weatherstripping: Dark Bronze Anodized Aluminum
6. Thresholds: Extruded Architectural Bronze – Mill Finish

D. Finish: BHMA 613/640 (US10B); except:
   2. Continuous Hinges: BHMA 710 (US10B)
   5. Weatherstripping: Dark Bronze Anodized Aluminum.
   6. Thresholds: Extruded Architectural Bronze, Oil-Rubbed

E. Finish: BHMA 605/632 (US3); except:
   1. Continuous Hinges: BHMA 630 (US32D)
   2. Door Closers: Powder Coat to Match
   3. Latch Protectors: BHMA 630 (US32D)
   5. Thresholds: Extruded Architectural Bronze, Polished

F. Finish: BHMA 606/633 (US4); except:
   1. Continuous Hinges: BHMA 630 (US32D)
   2. Continuous Hinges: BHMA 688 (US4)
   3. Door Closers: Powder Coat to Match
   4. Latch Protectors: BHMA 630 (US32D)
   5. Weatherstripping: Gold Anodized Aluminum
   6. Thresholds: Extruded Architectural Bronze – Mill Finish

EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.
3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

2. Custom Steel Doors and Frames: HMMA 831.

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

I. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.
2. Furnish permanent cores to Owner for installation.

J. Lead Protection: Lead wrap hardware penetrating lead-lined doors. Levers and roses to be lead lined. Apply kick and armor plates on lead-lined doors with adhesive as recommended by manufacturer.

K. Wiring: Coordinate with Division 26, ELECTRICAL sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Testing and labeling wires with Architect’s opening number.

L. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

M. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

N. Closer/ Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

T. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 FIELD QUALITY CONTROL

A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.

1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.04 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. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer’s Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

47504 X-16553 Version 1

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END OF SECTION
SECTION 08 8000
GLAZING

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. Glass products.
      2. Glazing sealants.
      4. Miscellaneous glazing materials.

1.3 DEFINITIONS
   A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
   B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.4 COORDINATION
   A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.5 ACTION SUBMITTALS
   A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For Installer.
B. Product Certificates: For glass.
C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.
2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Thickness: Where glass thickness is indicated, it is a minimum.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Install gaskets so they protrude past face of glazing stops.

3.5 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type G1: Fully tempered float glass.
   1. Minimum Thickness: 6 mm.
   2. Safety glazing required.

END OF SECTION
SECTION 09 2216
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 partitions.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS
   A. Product Certificates: For each type of code-compliance certification for studs and tracks.
   B. Evaluation Reports: For firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

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 Stud Manufacturers Association.

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 on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft..

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.


B. Studs and Tracks: ASTM C 645.

1. Steel Studs and Tracks:

   a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

      1) **CEMCO:** California Expanded Metal Products Co.
      2) **Marinoware.**
      3) **SCAFCO Steel Stud Company.**
      4) **Steel Network, Inc. (The).**

   b. Minimum Base-Metal Thickness: 0.0269 inch.
   c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:

   1. Deflection Track: Steel sheet top track 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.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.


H. 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 0.0179 inch, and depth required to fit insulation thickness indicated.
2.3 AUXILIARY MATERIALS
   
   A. General: Provide auxiliary materials that comply with referenced installation standards.
      
      1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power,
         and other properties required to fasten steel members to substrates.
      
   B. 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.

3.3 INSTALLATION, GENERAL
   
   A. Installation Standard: ASTM C 754.
      
      1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to
         framing installation.
   
   B. Install framing and accessories plumb, square, and true to line, with connections securely
      fastened.
   
   C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim,
      grab bars, toilet accessories, furnishings, or similar construction.
   
   D. Install bracing at terminations in assemblies.
   
   E. 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. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

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 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 that penetrate 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 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. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. 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.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. 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.

END OF SECTION
SECTION 09 2900

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.

B. Related Requirements:

1. Section 07 9219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
2. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Sound-attenuation blankets.

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

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 C840 requirements or gypsum board manufacturer’s written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 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 E90 and classified according to ASTM E413 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. Gypsum Board, Type X: ASTM C1396/C1396M.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation; Saint-Gobain North America.
      b. Georgia-Pacific Gypsum LLC.
      c. National Gypsum Company.
      d. USG Corporation.
   2. Thickness: 5/8 inch.
2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.

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.

2.6 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
   1. Use screws complying with ASTM C954 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.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

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 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. 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.

C. 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.

D. Form control and expansion joints with space between edges of adjoining gypsum panels.

E. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. 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.

F. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: As indicated on Drawings.

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-shaped 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.

3.4 INSTALLATION OF 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.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.

2. LC-Bead: Use at exposed panel edges.

3.5 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 C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. 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 09 9123 "Interior Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.6 INSTALLATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish 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
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 interior 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 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.5 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For testing agency.
   B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
   C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For finishes to include in maintenance manuals.
1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site 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.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

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: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 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 or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Armstrong World Industries, Inc.
2. Acoustical Panel Ceiling: APC1, Armstrong OPTIMA HEALTH ZONE, 3114PB
   b. Light Reflectance (LR): Not less than 0.86.
   c. Noise Reduction Coefficient (NRC): Not less than 0.95.
   d. Edge/Joint Detail: Square.
   e. Thickness: 1 inch.
   f. Modular Size: 24 by 24 inches.
   g. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.
   2. End Condition of Cross Runners: Override (stepped) type.
   3. Face Design: Flat, flush.

2.5 ACCESSORIES

A. 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.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft If retaining "Angle Hangers" Paragraph below, insert sizes or indicate on Drawings.

C. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.
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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

B. 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 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 to structure 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. 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.

6. Do not attach hangers to steel roof deck. Attach hangers to structural members.

7. 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.

8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
C. 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.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. 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 precise fit.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION
SECTION 09 6513
RESILIENT BASE AND 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. Thermoplastic-rubber base.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

1.4 DELIVERY, STORAGE, AND HANDLING
A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS
A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
C. Install resilient products after other finishing operations, including painting, have been completed.
PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE - RB

A. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
   2. Style and Location:
      a. Style C, Butt to Thermoplastic-rubber base is generally 0.125 inch (3.2 mm) thick; however, sculptured base thicknesses might vary.

B. Thickness: 0.125 inch.

C. Height: 4 inches.

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Job formed.

F. Inside Corners: Job formed.

G. Colors: As indicated by manufacturer's designations.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Cope corners to minimize open joints.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
C. Cover resilient products subject to wear and foot traffic until Substantial Completion.

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 surface preparation and the application of paint systems on interior substrates.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product. Include preparation requirements and application
      instructions.
      1. Indicate VOC content.
   B. Samples for Initial Selection: For each type of topcoat product.
   C. Product List: Cross-reference to paint system and locations of application areas. Use same
      designations indicated on Drawings and in schedules. Include color designations.

1.4 DELIVERY, STORAGE, AND HANDLING
   A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient
      temperatures continuously maintained at not less than 45 deg F.
      1. Maintain containers in clean condition, free of foreign materials and residue.
      2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS
   A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are
      between 50 and 95 deg F.
   B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5
      deg F above the dew point; or to damp or wet surfaces.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.
3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.

2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:
   a. Equipment, including panelboards.
   b. Uninsulated metal piping.
   c. Uninsulated plastic piping.
   d. Pipe hangers and supports.
   e. Metal conduit.
   f. Plastic conduit.
   g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   h. Other items as directed by Architect.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
3.5 INTERIOR PAINTING SCHEDULE

A. Gypsum Board Substrates:
1. Walls General – Egg Shell Finish
   a. Primer
      1) Sherwin Williams: ProMar 200 Zero VOC Latex Primer, B28W2600
      2) Benjamin Moore: Eco Spec Latex Primer 231
      3) PPG Paints: Pure Performance Latex Primer 9-900
   b. Intermediate Coat
      1) Sherwin Williams: ProMar 200 Zero VOC Latex Egg-Shel, B20-2600 Series
      2) Benjamin Moore: Ben Premium Latex Eggshell W626
      3) PPG Paints: Pure Performance Latex Eggshell 9-300
   c. Top Coat
      1) Sherwin Williams: ProMar 200 Zero VOC Latex Egg-Shel, B20-2600 Series
      2) Benjamin Moore: Ben Premium Latex Eggshell W626
      3) PPG Paints: Pure Performance Latex Eggshell 9-300

2. Walls – Laboratories - Epoxy Egg Shell Finish
   a. Primer
      1) Sherwin Williams: ProMar 200 Zero VOC Latex Primer, B28W2600
      2) Benjamin Moore: Eco Spec Latex Primer 231
      3) PPG Paints: Pure Performance Latex Primer 9-900
   b. Intermediate Coat
      1) Sherwin Williams: Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-300 Series
      2) Benjamin Moore: SuperSpec Acrylic Epoxy 256
      3) PPG Paints: Aquapon WB Epoxy 98-51
   c. Top Coat
      1) Sherwin Williams: Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-300 Series
      2) Benjamin Moore: SuperSpec Acrylic Epoxy 256
      3) PPG Paints: Aquapon WB Epoxy 98-51

3. Ceilings/Soffits
   a. Primer
      1) Sherwin Williams: ProMar 200 Zero VOC Latex Primer, B28W2600
      2) Benjamin Moore: Eco Spec Latex Primer 231
      3) PPG Paints: Pure Performance Latex Primer 9-900
   b. Intermediate Coat
      1) Sherwin Williams: ProMar 200 Zero VOC Latex Flat, B30-2600 Series
      2) Benjamin Moore: EcoSpec WB Flat 373
      3) PPG Paints: Pure Performance Latex Flat 9-100
   c. Top Coat
      1) Sherwin Williams: ProMar 200 Zero VOC Latex Flat, B30-2600 Series
      2) Benjamin Moore: EcoSpec WB Flat 373
      3) PPG Paints: Pure Performance Latex Flat 9-100

B. Ferrous Metal Substrates:
   1. Doors and Frames, Columns, and Misc Metals – Semi-Gloss Finish
      a. Primer
1) Sherwin Williams: Pro Industrial Pro Cryl Universal Primer  
2) Benjamin Moore: SuperSpec HP Acrylic Primer P04  
3) PPG Paints: Pitt Tech Primer/Finish DTM 90-712  

b. Intermediate Coat  
1) Sherwin Williams: Pro Industrial Acrylic Semi-Gloss, B66-650 Series  
2) Benjamin Moore: SuperSpec HP DTM Acrylic Semi Gloss P29  
3) PPG Paints: Pitt Tech Plus Semi Gloss 99-1210  

c. Top Coat  
1) Sherwin Williams: Pro Industrial Acrylic Semi-Gloss, B66-650 Series  
2) Benjamin Moore: SuperSpec HP DTM Acrylic Semi Gloss P29  
3) PPG Paints: Pitt Tech Plus Semi Gloss 99-1210  

C. Existing Concrete:  
1. Floor Sealer  
   a. Top Coat  
   1) Tnemec, Everthane Series 247, Clear Gloss  

2.  

END OF SECTION
SECTION 10 2600
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.
2. End-wall guards

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
   2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
   1. Corner and End-Wall Guards: 12 inches long. Include example top caps.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.3 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards (CG1): Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Material: Stainless-steel sheet, Type 304.
   a. Thickness: Minimum 0.0781 inch.
   b. Finish: Directional satin, No. 4.
2. Wing Size: Nominal 2 by 2 inches.

2.4 END-WALL GUARDS

A. Surface-Mounted, Metal, End-Wall Guards (CG2): Fabricated from one-piece, formed or extruded metal that covers entire end of wall; with formed edges.

1. Material: Stainless-steel sheet, Type 304.
   a. Thickness: Minimum 0.0781 inch.
   b. Finish: Directional satin, No. 4.
2. Wing Size: Nominal 2 inches.

2.5 MATERIALS
A. Adhesive: As recommended by protection product manufacturer.

2.6 FABRICATION
A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
C. Quality: Fabricate components with uniformly tight seams and joints and 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.

2.7 FINISHES
A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
B. 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 substrates and wall areas, with Installer present, 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. Installation Quality: Install wall and door protection according to manufacturer's written instructions, 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.
B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
3.3 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
SECTION 10 4413

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. 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.
B. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.

1.4 CLOSEOUT SUBMITTALS
A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION
A. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 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.
2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

   1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

      a. Babcock-Davis.
      b. Guardian Fire Equipment, Inc.
      c. JL Industries, Inc.; a division of the Activar Construction Products Group.
      d. Larsens Manufacturing Company.

B. Cabinet Construction: 1-hour fire rated.

   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. Cabinet Material: Cold-rolled steel sheet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

   1. **Square-Edge Trim:** 1-1/4- to 1-1/2-inch backbend depth.

E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

F. Cabinet Trim Material: Steel sheet.

G. Door Material: Steel sheet.

H. Door Style: Vertical duo panel with frame.

I. Door Glazing: Tempered float glass (clear).

J. Door Hardware: Manufacturer’s standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

   1. Provide manufacturer’s standard.
   2. Provide manufacturer’s standard hinge permitting door to open 180 degrees.

K. 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.

L. 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. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, 6 mm thick.

2.3 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.

2.4 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 walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. 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.

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
SECTION 11 5313

LABORATORY FUME HOODS

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. Bench-top laboratory fume hoods.
2. Piping and wiring within fume hoods for service fittings, light fixtures, fan switches, and
other electrical devices included with fume hoods.
3. Work tops within fume hoods.
4. Laboratory sinks and cup sinks in fume hoods.
5. Water, laboratory gas, and electrical service fittings in fume hoods.
B. Related Requirements:
1. Section 06 1000 "Rough Carpentry" for wood blocking for anchoring fume hoods.
2. Section 09 2216 "Non-Structural Metal Framing" for reinforcements in metal-framed
partitions for anchoring fume hoods.
3. Section 09 6513 "Resilient Base and Accessories" for resilient base applied to fume hood
base cabinets.

1.3 COORDINATION
A. Coordinate layout and installation of framing and reinforcements for lateral support of fume
hoods.
B. Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: For laboratory fume hoods.
   1. Include plans, elevations, sections, and attachment details.
   2. Indicate details for anchoring fume hoods to permanent building construction including
      locations of blocking and other supports.
3. Indicate locations and types of service fittings together with associated service supply connection required.
4. Indicate duct connections, electrical connections, and locations of access panels.
5. Include roughing-in information for mechanical, plumbing, and electrical connections.
6. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from the above items.
7. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
8. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples: For fume hood exterior finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Restricted-Bypass Fume Hoods with VAV Control and Steel Exterior:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Kewaunee, Supreme Air Venturi Fume Hoods or comparable product by one of the following:
   a. Labconco Corporation.
   b. Mott Manufacturing.

B. Source Limitations: Obtain laboratory fume hoods from single manufacturer.

1. Obtain laboratory fume hoods from same source as laboratory casework.

C. Product Designations: Drawings indicate sizes, types, and configurations of fume hoods by referencing designated manufacturer's catalog numbers. Other manufacturers' fume hoods of similar sizes, types, and configurations, and complying with the Specifications, may be considered. See Section 01 6000 "Product Requirements."

2.2 PERFORMANCE REQUIREMENTS

A. Containment: Provide fume hoods that comply with the following when tested according to ASHRAE 110 as modified below:

1. **As-Manufactured (AM) Rating:** AM 0.05 (0.05 ppm).
2. **As-Installed (AI) Rating:** AI 0.10 (0.10 ppm).
3. **Average Face Velocity:** 60 fpm plus or minus 10 percent with sashes fully open.
4. **Face-Velocity Variation:** Not more than 10 percent of average face velocity across the face opening with sashes fully open.
5. **Sash Position:** Fully open.

   a. Test hoods with horizontal sashes with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
   b. Test hoods with combination sashes fully raised, with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.

6. **Release Rate:** 4.0 L/min.
7. **Test Setup Modifications:** Conduct tests with a minimum of three and a maximum of five people in the test room and with two 1-gal. round paint cans, one 12-by-12-by-12-inch cardboard box, and three 6-by-6-by-12-inch cardboard boxes in the fume hood during the test. Position items from 6 to 10 inches behind the sash, randomly distributed, and supported off the work surface by 2-by-2-inch blocks.
8. **Walk-by Test:** At the conclusion of containment test, execute three rapid walk-bys at 30-second intervals, 12 inches behind the mannequin. Test-gas concentration during each walk-by shall not exceed 0.1 ppm and shall return to specified containment value within 15 seconds.
B. Static-Pressure Loss: Not more than 1/2-inch wg at 60-fpm face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

2.3 FUME HOODS

A. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods - Recommended Practices." Provide fume hoods UL listed and labeled for compliance with UL 1805.

B. Restricted-Bypass Fume Hoods: Provide restricted-bypass fume hoods. Partial compensating bypass above the sash opens after sash is closed to less than 20 percent open. Design partial bypass to maintain exhaust capacity of at least 25 cfm per sq. ft. of work surface regardless of sash position.

2.4 MATERIALS

A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.

B. Glass-Fiber-Reinforced Polyester: Polyester laminate with a chemical-resistant gel coat on exposed faces, and having a flame-spread index of 25 or less according to ASTM E 84.

C. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.

   1. Physical Properties:
      a. Flexural Strength: Not less than 10,000 psi.
      b. Modulus of Elasticity: Not less than 2,000,000 psi.
      c. Hardness (Rockwell M): Not less than 100.
      d. Water Absorption (24 Hours): Not more than 0.02 percent.
      e. Heat Distortion Point: Not less than 260 deg F.
      f. Flame-Spread Index: 25 or less according to ASTM E 84.

   2. Chemical Resistance: As follows when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
      a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
      b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).

   3. Color: Black

D. Polypropylene: Unreinforced polypropylene complying with ASTM D 4101, Group 01, Class 1, Grade 2.

E. Glass: Clear, laminated tempered glass complying with ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with two plies not less than 3.0 mm thick and with clear, polyvinyl butyral interlayer.
1. Ultraclear Glass: Glass plies each have visible light transmission not less than 91 percent.
3. Permanently mark safety glass with certification label of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. 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.

G. Fasteners: Provide stainless steel fasteners where exposed to fumes.

2.5 FABRICATION

A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 35-by-79-inch door opening.

B. Steel Exterior: Fabricate from steel sheet, 0.048 inch thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil and to allow access to plumbing lines and service fittings. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.

C. Ends: Fabricate with double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

D. Splay top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.

E. Interior Lining: Provide one of the following unless otherwise indicated:
   1. Glass-fiber-reinforced polyester, not less than 3/16 inch thick.

F. Lining Assembly: Unless otherwise indicated, assemble with stainless steel fasteners or epoxy adhesive, concealed where possible. Seal joints by filling with chemical-resistant sealant during assembly.
   1. Fasten lining components together with stainlesssteel cleats or angles to form a rigid assembly to which exterior panels are attached.
   2. Fasten lining components to a rigid frame assembly fabricated from stainless steel and to which exterior panels are attached.
   3. Punch fume hood lining side panels to receive service fittings and remote controls. Provide removable plug buttons for holes not used for indicated fittings.

G. Rear Baffle: Unless otherwise indicated, provide baffle, of same material as fume hood lining, at rear of hood with openings at top and bottom. Secure baffle to cleats at rear of hood with stainless steel screws. Fabricate baffle for easy removal for cleaning behind baffle.
   1. Provide preset baffles.
2. Provide epoxy-coated, stainless steel screen at bottom baffle opening to prevent paper from being drawn into the exhaust plenum behind baffles.

H. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.
   1. Duct-Stub Material: stainless steel or glass-fiber-reinforced polyester.

I. Bypass Grilles: Provide grilles at bypass openings of fume hoods.

J. Sashes: Provide operable sashes of type indicated.
   1. Fabricate from 0.050-inch-thick stainless steel. Form into four-sided frame with bottom corners welded and finished smooth. Make top member removable for glazing replacement. Set glazing in chemical-resistant, U-shaped gaskets.
   2. Glaze with laminated safety glass.
   3. Counterbalance vertical-sliding sash with sash weight and stainless steel cable system to hold sash in place regardless of position. Provide ball-bearing sheaves, plastic glides in stainless steel guides, and stainless steel lift handles. Provide rubber bumpers at top and bottom of each sash unit.

K. Airfoil: Unless otherwise indicated, provide airfoil at bottom of fume hood face opening with 1-inch space between airfoil and work top. Sash closes on top of airfoil, leaving 1-inch opening for air intake. Airfoil directs airflow across work top to remove heavier-than-air gases and to prevent reverse airflow.
   1. Fabricate airfoil from stainless steel.

L. Light Fixtures: Provide vaporproof, two-tube, rapid-start, fluorescent light fixtures, of longest practicable length; complete with tubes at each fume hood. Shield tubes from hood interior with 1/4-inch-thick laminated glass or 3-mm-thick tempered glass, sealed into hood with chemical-resistant rubber gaskets. Provide units with fluorescent tubes easily replaceable from outside of fume hood.
   1. Provide fluorescent tubes with color temperature of 3500 K and minimum color-rendering index of 85.

M. Filler Strips: Provide as needed to close spaces between fume hoods or fume hood base cabinets and adjacent building construction. Fabricate from same material and with same finish as fume hoods or fume hood base cabinets, as applicable.

N. Ceiling Extensions: Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to ceiling.

O. Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.

P. Comply with requirements in other Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods unless otherwise indicated.
2.6 FUME HOOD BASE CABINETS BASE STANDS WORK TOPS SINKS AND SERVICE FITTINGS

A. Comply with Section 12 3553 "Metal Laboratory Casework." Provide metal base cabinets in finish matching fume hood exterior finish.

B. Work Tops: Epoxy.
   1. Work-Top Configuration: Raised (marine) edge with rounded edge and corners.
   2. Where acid storage cabinets are indicated beneath fume hoods, provide holes in work tops as need to accommodate cabinet vents.
   3. Where epoxy sinks occur in epoxy work tops, provide integral sinks bonded to tops with invisible joint line.

C. Cup Sinks: Epoxy, 3-by-6-inch oval.
   1. Provide epoxy cup sinks with polypropylene strainers and integral tailpieces.

D. Fume Hood Base Stands: Welded steel tubing legs, not less than 2 inches square with channel stretchers and aprons. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to aprons. Provide leveling device welded to bottom of each leg.
   1. Structural Performance: Capable of withstanding 50-lb/ft. work top, 75 lb/ft. on work top, plus weight of hood, without permanent deformation or excessive deflection.
   2. Leg Shoes: Black vinyl or rubber, open-bottom, slip-on type.

2.7 CHEMICAL-RESISTANT FINISH

A. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.

B. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
   1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
   2. Colors for Fume Hood Finish: As selected by Architect from manufacturer's full range.

2.8 ACCESSORIES

A. Sash Alarm: Provide fume hoods with audible and visual alarm that activates when sash is opened beyond preset position.
   1. Provide with silence and test switches.
B. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 50 percent of sash height. Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood.

2.9 SOURCE QUALITY CONTROL

A. Demonstrate fume hood performance before shipment by testing fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article. Provide testing facility, instruments, equipment, and materials needed for tests.

2.10 SNORKEL EXHAUST HOODS

A. Basis of Design Product: Subject to compliance with requirements, provide Nederman Extraction Arms, Model FX2 100 CHEM or comparable product.
   1. Mounting: Ceiling, connection up. Provide mounting brackets and extensions for a complete installation.
   2. Hood: Transparent Combi-hood

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Comply with requirements in Section 12 3553 "Metal Laboratory Casework" for installing fume hood base cabinets, work tops, and sinks.

C. Comply with requirements for installing water and laboratory gas service fittings and electrical devices.
   1. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work-top material. Securely anchor fittings to fume hoods unless otherwise indicated.
3.3 ADJUSTING AND CLEANING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION
SECTION 12 3553
WOOD LABORATORY CASEWORK

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. Wood laboratory casework.
2. Utility-space framing at backs of base cabinets.
3. Filler and closure panels.
4. Laboratory countertops.
5. Shelves.
6. Laboratory sinks.
7. Laboratory accessories.
8. Water, laboratory gas, and electrical service fittings.

B. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring
laboratory casework.
2. Section 09 2216 "Non-Structural Metal Framing" for reinforcements in metal-framed
partitions for anchoring laboratory casework.
3. Section 09 6513 "Resilient Base and Accessories" for resilient base applied to laboratory
casework.
4. Section 11 5313 "Laboratory Fume Hoods" for fume hoods, including base cabinets and
countertops under fume hoods.

1.3 DEFINITIONS

A. Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces
not usually visible after installation.

B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including
bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or
behind glass doors.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1.5 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.

B. Coordinate installation of laboratory casework with installation of laboratory equipment.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For laboratory casework.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.

2. Indicate types and sizes of casework.

3. Indicate manufacturer's catalog numbers for casework.

4. Show fabrication details, including types and locations of hardware.

5. Indicate locations and types of service fittings.

6. Include details of utility spaces showing supports for conduits and piping.

7. Include details of support framing system.

8. Include details of exposed conduits, if required, for service fittings.

9. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and laboratory equipment.

10. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples: For casework finishes and materials requiring color selection.

D. Samples for Initial Selection: For casework finishes and materials requiring color selection.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Test Reports:

1. Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard.

2. Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface material with requirements specified for chemical and physical resistance.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA 8 W.
1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet-work are complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Established Dimensions: Where laboratory casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Field Measurements: Where laboratory casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kewaunee Scientific Corporation; Signature Series or a comparable product by one of the following:

1. Diversified Woodcrafts, Inc.
2. ICI Scientific
3. Mott Manufacturing Ltd.

B. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.

1. Obtain countertops sinks accessories and service fittings from casework manufacturer.

C. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer’s catalog numbers. Other manufacturers’ laboratory casework of similar sizes and similar door and drawer configurations and complying with the Specifications may be considered. See Section 016000 "Product Requirements."
2.2 PERFORMANCE REQUIREMENTS

A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:

1. Support Framing System: 600 lb/ft..
2. Suspended Base Cabinets (Internal Load): 160 lb/ft..
3. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft..
4. Wall Cabinets (Upper Cabinets): 160 lb/ft..
5. Shelves: 40 lb/sq. ft..

2.3 CASEWORK, GENERAL

A. Casework Product Standard: Comply with SEFA 8 W, "Laboratory Grade Wood Casework."

B. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.

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.

2.4 WOOD CASEWORK

A. Design: Reveal overlay with square edges.

1. Provide 1/8-inch reveals between doors and drawers that are adjacent.

B. Wood Species: Red oak.

1. Wood Stain Colors and Finishes: As selected by Architect from casework manufacturer's full range.

C. Cut: Quarter sliced/sawn.

D. Veneer Matching:

1. Provide veneers for each cabinet from a single flitch, book or slip and balance matched.

   a. Provide continuous matching of adjacent drawer fronts within each cabinet.

E. Grain Direction:

1. Doors: Vertical with continuous vertical matching.
2. Drawer Fronts: Vertical with continuous vertical matching.
3. Face Frame Members: Lengthwise.
5. Bottoms and Tops of Units: Side to side.
F. Exposed Materials:

1. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
2. plywood: Hardwood plywood, either veneer core or particleboard core with face veneer of species indicated. Grade A exposed faces, at least 1/50 inch thick, and Grade J crossbands. Provide backs of same species as faces.
4. Edge banding: Wood veneer of same species as face veneer.

G. Semi-exposed Materials:

1. Wood: Provide solid wood or hardwood plywood for semi-exposed surfaces unless otherwise indicated.

H. Concealed Materials:

1. Solid Wood: With no defects affecting strength or utility.
3. Particleboard.
4. MDF.
5. Hardboard.

2.5 WOOD CABINET MATERIALS

A. General:

1. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.

C. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.

D. Particleboard: ANSI A208.1, Grade M-2.

E. Hardboard: ANSI A135.4, Class 1 tempered.

2.6 AUXILIARY CABINET MATERIALS

A. Acid Storage-Cabinet Lining: 1/4-inch-thick, polyethylene, polypropylene, epoxy, or phenolic-composite lining material.

B. Tempered Glass for Glazed Doors: Clear tempered glass complying with ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.
2.7 CABINET HARDWARE

A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Butt Hinges: Stainless-steel, five-knuckle hinges complying with ANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two for doors 48 inches high or less and three for doors more than 48 inches high.

C. Hinged-Door and Drawer Pulls: Solid-aluminum, stainless steel, or chrome-plated-brass, back-mounted pulls. Provide two pulls for drawers more than 24 inches wide.
   1. Design: Wire pulls.
   2. Overall Size: 1-1/4 by 4-1/2 inches.

D. Door Catches: Nylon-roller spring catches. Provide two catches on doors more than 48 inches high.

E. Steel Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with ANSI/BHMA A156.9, Type B05091.
   1. Provide Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
   2. Provide Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
   3. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Full-extension, ball-bearing type.

F. Adjustable Shelf Supports: ANSI/BHMA A156.9, powder-coated steel shelf rests, Type B04013.

2.8 COUNTERTOP SHELF AND SINK MATERIALS

   1. Physical Properties:
      a. Flexural Strength: Not less than 10,000 psi.
      b. Modulus of Elasticity: Not less than 2,000,000 psi.
      c. Hardness (Rockwell M): Not less than 100.
      d. Water Absorption (24 Hours): Not more than 0.02 percent.
      e. Heat Distortion Point: Not less than 260 deg F.
   2. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
      a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
      b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
2.9 WOOD CABINET FABRICATION

A. Construction: Provide wood-faced laboratory casework complying with SEFA 8 W.

1. Bottoms of Base Cabinets and Tall Cabinets: 3/4-inch-thick, veneer-core hardwood plywood.
2. Tops and Bottoms of Wall Cabinets and Tops of Tall Cabinets: 1-inch-thick, veneer-core hardwood plywood.
3. Ends of Cabinets: 3/4-inch-thick, hardwood plywood.
5. Base Cabinet Top Frames: 3/4-by-2-inch solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
7. Unexposed Backs of Cabinets: 1/4-inch-thick hardboard dadoed into sides, bottoms, and tops unless otherwise indicated.
8. Drawer Fronts: 3/4-inch-thick, particleboard- or MDF-core hardwood plywood or solid hardwood.
9. Drawer Sides and Backs: 1/2-inch-thick, solid hardwood or veneer-core hardwood plywood, with glued dovetail or multiple-dowel joints.
10. Drawer Bottoms: 1/4-inch-thick, veneer-core hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch-thick material for drawers more than 24 inches wide.
11. Doors: 3/4 inch thick, with particleboard or MDF cores and hardwood face veneers and crossbands.

   a. Provide solid-hardwood stiles and rails.


   a. Material: Particleboard with hardwood face veneers and crossbands.

B. Utility-Space Framing: Steel framing units consisting of two steel slotted channels complying with MFMA-4, not less than 1-5/8 inches square by 0.105-inch nominal thickness, that are connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch steel flat bars. Framing units may be made by welding channel material into rectangular frames instead of using U-shaped brackets.

C. Removable Backs: Provide backs that can be removed from within cabinets at utility spaces.

D. Filler and Closure Panels: Provide where indicated and as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as adjacent exposed casework surfaces unless otherwise indicated.

1. Provide knee-space panels (modesty panels) at spaces between base cabinets, where indicated.
2. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
3. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
2.10  WOOD FINISH

A. Preparation: Sand lumber and plywood before assembling. Sand edges of doors, drawer fronts, and molded shapes with profile-edge sander. Sand after assembling for uniform smoothness at least equivalent to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.

B. Staining: Remove fibers and dust and apply stain to exposed and semi-exposed surfaces as necessary to match approved Samples. Apply stain to produce a consistent appearance. Apply wash-coat sealer before applying stain to closed-grain wood species.

C. Chemical-Resistant Finish: Apply laboratory casework manufacturer's standard two-coat, chemical-resistant, transparent finish. Sand and wipe clean between coats. Topcoat(s) may be omitted on concealed surfaces.

1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8 W. Acceptance level for chemical spot test shall be no more than for Level 3 conditions.

2.11  COUNTERTOPS, SHELVES AND SINKS

A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch.

B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.

1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2, unless otherwise indicated.
2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches less than sink depth. Provide in same material as strainer.

C. Epoxy Countertops and Sinks:

1. Countertop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.
   a. Flat Configuration: 1 inch thick with continuous drip groove on underside 1/2 inch from overhang edge.
      1) Edges and Corners: Beveled.
      2) Backsplash: Applied.
   b. Construction: Uniform throughout full thickness.

2. Sink Fabrication: Molded in one piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch minimum thickness.
   a. Provide with polypropylene strainers and tailpieces.
   b. 
c. Provide sinks for drop-in installation with 1/4-inch-thick lip around perimeter of sink.

D. Cup Sinks: Provide in material indicated, 3-by-6-inch oval.
   1. Epoxy Cup Sinks: Provide with polypropylene strainers and integral tailpieces.

E. Fixed Casework Adjustable Shelving

F. Fixed Furniture Upper Carrier: Shelving Support Assemblies are designed to add shelving to center benches. Each assembly consists of four uprights with slots on 1" centers and a top frame. They are 12" deep in lengths as shown. Furnish each assembly with mounting brackets for attaching to the counter top and cabinets below
   1. Provide with adjustable shelving as indicated on the drawings.
   2. Vertical Wire Raceway: Provide vertical wire raceway between shelving uprights
      a. Height: 18"
      b. Services: Provide electrical outlets as indicated on drawings

2.12 LABORATORY ACCESSORIES

A. Plastic or Resin Pegboards: Polypropylene, epoxy, or phenolic-composite pegboards with removable polypropylene pegs and stainless steel drip troughs with drain outlet.

2.13 WATER AND LABORATORY GAS SERVICE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. WaterSaver Faucet Co.
      a. Recessed Safety Station with Drain Pan, Exposed Shower Head: Recessed barrier-free eye/face wash and shower with pull down opening cover and automatic activation
         1) Water Saver, Model SSBF2152
      b. Barrier Free Emergency Shower, semi concealed
         1) Water Saver, Model ESBF658
      c. Deck Mounted, Eyewash Autoflow 90 degree Swivel
         1) Water Saver, EW895 - Provide control handing as indicated on drawings
      d. Deck Mounted Laboratory Single Faucet with Wrist Blade Handle:
         1) Water Saver, Model LA412VB-BH
      e. Deck Mounted Laboratory Mixing Faucet with Wrist Blade Handles:
         1) Water Saver, Model L611VB-BH – Provide control handing as indicated on drawings
      f. Ball Valves Wall Mounted: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf to operate. Provide units designed for working pressure up to 75 psig, with serrated outlets.
         1) Water Saver, Model L4200-158FT
      g. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.
      h. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.
B. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures - Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

C. Materials: Fabricated from cast or forged red brass unless otherwise indicated.
   1. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.
   2. Finish: Chromium plated.

D. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CASEWORK

A. Comply with installation requirements in SEFA 2. Install level, plumb, and true in line; shim as required using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

   1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
   2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
   3. Variation of Faces of Casework from a True Plane: 1/8 inch in 10 feet.
   5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 16 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

   1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than two fasteners per side.
D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 16 inches o.c.

E. Install hardware uniformly and precisely.

F. Adjust operating hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces true in plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

C. Fastening:
   1. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.

D. Provide holes and cutouts required for service fittings.

E. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

F. Dress joints smooth, remove surface scratches, and clean entire surface.

3.4 INSTALLATION OF SINKS

A. Comply with installation requirements in SEFA 2.

B. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not shop prepared. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

C. Drop-in Installation of Epoxy Cup Sinks: Rout groove in countertop to receive sink rim if not shop prepared. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

3.5 INSTALLATION OF LABORATORY ACCESSORIES

A. Install accessories in accordance with Shop Drawings, installation requirements in SEFA 2, and manufacturer’s written instructions.
B. Securely fasten adjustable shelving supports, stainless steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.

C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

D. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.6 INSTALLATION OF SERVICE FITTINGS

A. Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.

B. Install fittings in accordance with Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.7 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c.

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 Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples: For color, letter style, and graphic representation required for each identification material and device.
C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
D. Valve numbering scheme.
E. Valve Schedules: For each piping system to include in maintenance manuals.

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 MANUFACTURERS

A. Acceptable Manufactures: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Marking Services, Inc.

2.2 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: Black.
   3. Background Color: Background to contrast with letter color.
   4. Maximum Temperature: Able to withstand temperatures up to 160°F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 4 inches wide by 1-1/2 inches high.
   6. 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.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment’s Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Section number and title where equipment is specified.

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 Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Background to contrast with letter color.

D. Maximum Temperature: Able to withstand temperatures up to 160°F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. 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.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 STENCILS FOR PIPING

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.


2. Paint: Standardized colors for the entire piping system shall be painted per Division 09 painting specification. Paint material is based on colors and model numbers manufactured by Glidden unless otherwise indicated. Subject to compliance with requirements, provided named color or comparable product as approved. Use the following colors for banding of all piping and conduit:

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire-Suppression</td>
<td>Red</td>
</tr>
</tbody>
</table>

3. Standardized Sizes: Tags shall be at least 1-1/2 inches in diameter, with depressed block characters 1/4 inch high. Titles shall be lettered on bands. Uppercase letters and Arabic numerals shall be used. Where pipes or conduits are too small or not readily accessible for such application securely fasten a brass identification tag at appropriate locations. Identification of the material contained in piping and conduits in accordance with the table below:

<table>
<thead>
<tr>
<th>BAND AND LETTER SIZE ALL DIMENSIONS IN INCHES</th>
<th>Width of Color Band</th>
<th>Size of Letters and Numerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Diameter of Pipe Covering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2 to 1-1/4</td>
<td>8</td>
<td>1/2</td>
</tr>
<tr>
<td>1-1/2 to 2</td>
<td>8</td>
<td>3/4</td>
</tr>
<tr>
<td>2-1/4 to 3-1/4</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>3-1/2 to 6</td>
<td>12</td>
<td>1-1/4</td>
</tr>
<tr>
<td>8 to 10</td>
<td>24</td>
<td>2-1/2</td>
</tr>
<tr>
<td>Over 10</td>
<td>32</td>
<td>3-1/2</td>
</tr>
</tbody>
</table>
4. Pipe Identification: Identify pipe at wall penetrations, machine or tank connections, and at not over 50 foot intervals. Marker identification should be visible from the floor. Mark each pipe circuit with stencil. Stencil shall include flow arrow and identification marks as follows:

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire</td>
<td>Fire</td>
</tr>
</tbody>
</table>

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4 inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass S-hook.

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.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 inches by 5-1/4 inches minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as “DANGER,” “CAUTION,” or “DO NOT OPERATE.”

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Equipment to be identified with plastic nameplates includes but is not limited to sprinkler alarm valve assemblies, backflow preventers, etc.

B. Identify valves with tags.
3.3 EQUIPMENT LABEL INSTALLATION
   A. Install or permanently fasten labels on each major item of equipment.
   B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION
   A. Piping Color-Coding: Painting of piping is specified in Division 09 painting sections – All pipe identification shall be stenciled legibly on pipe.
   B. 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 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

3.5 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.
   B. List tagged valves in a valve schedule in aluminum frame with clear plastic shield. Install at location as directed by Owner’s Representative.

3.6 WARNING-TAG INSTALLATION
   A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION
SECTION 21 1313

FIRE PROTECTION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes labor and materials for the renovation of an existing hydraulically calculated automatic, wet-pipe sprinkler system in areas as specified, and as shown on the Drawings, complete in all respects and ready for operation.

1. Work includes the renovation and design of an automatic sprinkler system, complete and ready for operation.
2. 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 automatic sprinkler system shall be fixed water type or pre-action type fire protection sprinkler system with piping supply to fusible sprinkler heads for control of fire.

B. The sprinkler system shall be designed to meet the more stringent of the requirements of NFPA 13.

C. All sprinkler heads in general shall be in a straight line, parallel to the lines of the building and shall be located in the approximate center of ceiling tiles.

1. Sprinkler head quantities, where shown, are the minimum, which must be provided. If additional heads are required to meet NFPA 13, the location of additional heads must be approved by the Architect.
2. Contractor shall submit Sprinkler Head locations to the Architect for location and type approval prior to completing the sprinkler system design, unless otherwise instructed, in writing, by the Architect.

D. Work shall be installed in accordance with the Drawings, Specifications and the AHJ. Devices and equipment shall be listed by Underwriters' Laboratories, Inc. or Factory Mutual-approved, individually and as a system, as applicable.

E. Sprinkler heads shall be spaced, located, and positioned as shown on the Architectural reflected ceiling plans, where shown, as specified and as required to suit the building partition layout according to Sections 8.5 and Section 8.6 of NFPA 13.
F. Piping sizes and configurations shall be on the basis of hydraulic calculations. Where head layouts shown on the Drawings or requirements specified are more stringent than NFPA requirements, the more stringent requirements shall apply.

G. Zone the wet-pipe sprinkler system with a maximum 52,000 sq. ft. area limitation per zone.

H. 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 Chapter 22 of NFPA 13 and FM Global with the following exceptions:
1. Pipe frictions losses may be calculated by using the nearest foot for all piping over one foot in length. Vertical length less than one foot shall be included for elevation purposes only.
2. Calculate flows to the nearest whole gallon.
3. Velocities in underground piping shall not exceed 16 feet per second. Velocities in all other piping shall not exceed 20 feet per second. Velocities in standpipes must be calculated based on the combined sprinkler flow and hose flow.
4. Total sprinkler system flow shall not exceed 110 percent of the required flow.
5. Provide a minimum safety factor of 10 percent on all hydraulically calculated sprinkler systems.

B. Sprinkler system hydraulic calculations shall be based on the following:
1. Laboratories -- Ordinary Hazard Group 2 with a design density of 0.20 gpm over the most remote 1500 square foot with a maximum head coverage of 130 square foot per head.
2. Provide 250 gpm hose stream allowance for Ordinary Hazard and 100 gpm for Light Hazard, per NFPA 13.

C. Hydraulic calculations shall be performed by a State of Texas Licensed Responsible Managing Employee (RME) in the direct employ of the fire protection contractor.

D. Hydraulic Calculations shall be based on flow test conducted by this contractor or flow test information provided by the Owner. This Contractor is responsible for basing the hydraulic calculations on the most current conditions.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Provide total hydraulically designed sprinkler system with plans, elevations, sections, details, and related attachments including Wiring Diagrams for power, signal, and control wiring.

C. All submittals shall be provided to FM Global and A/E for review and approval prior to any work.

D. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
E. Qualification Data: For qualified Installer and Professional Engineer.

F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, FM Global, including hydraulic calculations if applicable.

G. Welding certificates.

H. 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."

I. Field quality-control reports.

J. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
      a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

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.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13, 2016, "Installation of Sprinkler Systems Including Four Stories in Height."
   2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.1 SPRINKLERS

A. Approved Manufacturers: Viking, Victaulic, Tyco or Reliable.

B. 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. Install corrosion-resistant sprinkler heads where they are exposed to weather, moisture, or corrosive vapors.
   2. 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 Section 6.2.8 of NFPA 13.
3. Sprinklers in areas with suspended ceilings shall have pipe and fittings located above the suspended ceiling.
4. Sprinkler heads shall be located above and below metal mesh ceiling. Refer to architectural RCP for location of metal mesh ceilings.
5. All concealed heads shall have white finish, except in wood ceilings where a factory painted custom dark brown finish shall be provided.

C. Sprinkler heads in unfinished areas shall be Quick Response upright or sidewall with a brass finish, manufactured by Viking Microfast or approved equivalent.

D. Provide sprinkler piping connection to compressed gas cabinet sprinkler heads. Refer to architectural plans for locations of compressed gas cabinets.

E. Sprinkler heads shall be UL Listed.

F. The use of extended coverage type heads is not allowed.

2.2 VALVE SUPERVISORY SWITCHES

A. Contractor shall furnish and install supervisory switches. Coordinate wiring of switches with Division 26 Electrical Sections.

2.3 WATERFLOW SWITCHES

A. Waterflow pressure switches shall be furnished and installed by this Contractor and wired under provisions of Division 26 Electrical Sections. Coordinate wiring of flow switches with Division 26 Electrical Sections.

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.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
F. Install sprinkler piping with drains for complete system drainage.

G. Install alarm devices in piping systems.

H. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

I. Fill sprinkler wet system piping with water.

J. In areas with wood ceilings, provide sprinkler heads in the ceiling and above the ceiling in compliance with NFPA 13.

3.2 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. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. 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.

K. 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.
L. 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.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

O. No welded joints and/or outlets are allowed on the pre-action piping system.

3.3 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. Specialty Valves:
   1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

3.4 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

C. Coordinate the location of sprinkler system piping around all other trades, such as HVAC, plumbing and electrical, prior to installation.

D. Do not route any sprinkler system components through electrical equipment rooms, unless they serve that room.

E. The supply line for individual sprinkler heads located in suspended ceilings shall be tapped off the top of the branch lines (return bend). Piping serving individual sprinkler heads located in suspended ceilings shall not be supplied off the bottom of branch lines. Refer to plumbing drawings for detail.

F. In exposed areas with ductwork 48” and wider, provide sprinkler heads both above and below ductwork as outlined in NFPA 13.

G. Provide sprinkler heads both above and in ceilings constructed of wood, as required by NFPA 13.
3.5 ESCUTCHEON INSTALLATION
   A. Install escutcheons for penetrations of walls, ceilings, and floors.

3.6 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. Comply with requirements for joint sealants in Division 07 Section, Joint Sealants.
   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. Comply with requirements for joint sealants in Division 07 Section, Joint Sealants.
   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. Comply with requirements for firestop materials and installations in Division 07 Section, Penetration Firestopping.

3.7 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.

3.8 IDENTIFICATION
   A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553, Electrical Identification.

3.9 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.
   3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
   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. Coordinate with fire-pump tests. Operate as required.
   8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

END OF SECTION
SECTION 22 0500
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the common work results requirements for Division 22, Plumbing. Applicable provisions of this Section apply to all Sections of Division 22.

1.2 GENERAL

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements and provide coordination drawings.

B. Prior to starting work, Contractor shall provide 1/4 inch scale coordination drawings for all areas of the buildings for approval by Architect/Engineer.

1. Drawings shall show all equipment, ductwork, cable trays, fire protection systems, coil pull spaces, chilled water, heating water, and condensate piping and trap, electrical conduit, electrical control panels, etc. installed to verify space allocation and coordination of trades.

2. Provide plan and elevation views detailing installation.

3. Do not proceed with construction of plumbing systems until Drawings have been approved by Architect, Engineer, and Owner.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe 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 plumbing 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.
1.4 CODE REQUIREMENTS AND PERMITS
A. Perform work in accordance with applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.
B. Resolve code violations discovered in contract documents with Engineer prior to award of Contract. After award of Contract, make correction or addition necessary for compliance with applicable codes at no additional cost to Owner.
C. Obtain and pay for all permits and inspections.

1.5 SUBMITTALS
A. Material and Equipment List: Within 30 days after award of the contract and before orders are placed or shop drawings are submitted, submit a list of equipment and principal materials specified. Give names of manufacturers, catalog and model numbers, and such other supplementary information as necessary for identification.
B. Material and Equipment Shop Drawings: Submit all detailed shop drawings, descriptive literature, physical data, and performance data at one time for review for items of equipment and for principal materials proposed for installation. Include identifying symbols and equipment numbers used in plans and specifications, with reference to specification paragraphs, and drawing numbers of all equipment and material submitted.
C. Final Submittal: In addition to number of copies of shop drawings and other data required for review submittals, maintain a separate file of final approved copies of such material. Deliver approved copies in a hard-back binder for the Owner's use. Incorporate changes and revisions made throughout construction period. Delivery of approved copies is a condition of final acceptance for the project.
D. Contractor's Check: Shop drawings will be submitted only by the Contractor. Indicate by signed stamp that the drawings have been checked, that the work shown on the drawings is in accordance with contract requirements and that dimensions and relationship with work of other trades have been checked. If drawings are submitted for approval that have not been checked and signed by the Contractor, they will be returned for checking before being considered by the Architect/Engineer.

1.6 OPERATING AND MAINTENANCE INSTRUCTIONS
A. The Contractor shall furnish five copies of commercially available standard operation and maintenance data, including operating instructions, maintenance instructions and parts listings. Detailed requirements for these items are as follows:
   1. Information required for the preparation of O&M manuals may be furnished in the form of manufacturers’ standard brochures, schematics, and other printed instructions. Clearly distinguish between information which applies to the equipment and information which does not apply. Data shall include as a minimum the following items:
      a. Recommended procedures and frequencies for preventive maintenance, inspection, adjustment, lubrication, cleaning, etc.
      b. Special tools and equipment required for testing and maintenance.
      c. Parts lists reflecting the true manufacturer's name, part number, and nomenclature.
d. Recommended spares by part number and nomenclature and spare stocking levels.
e. Integrated mechanical and electrical system schematics and diagrams to permit operation and troubleshooting after acceptance of the system.
f. Troubleshooting, checkout, repair, and replacement procurement procedures.
g. Operating instructions including start-up and shutdown procedures.
h. Safety considerations including load limits, speed, temperature, and pressure.

B. Provide O&M manuals for all plumbing equipment. Coordinate O&M manuals with Division 01.

C. Upon completion of work, and at time designated by the Architect/Engineer, provide services of a competent representative of the Contractor for a period of at least 40 hours to instruct the Owner's Representative in the operation and maintenance of the entire system.

1.7 PROJECT RECORD DOCUMENTS

A. Preparation:
1. Maintain at the job site a separate set of white prints of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings.
2. Mark the drawings with a colored pencil.
3. Prepare, as the work progresses and upon completion of work, drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed
4. Include flow-line elevation of sewer lines.
5. Record underground and underslab piping installed, dimensioning exact location and elevation of such piping.
6. Coordinate requirements for Project Record Documents with Division 01.

B. Deliver: At conclusion of project, obtain without cost to Owner, reproducibles of original mechanical drawings and transfer as-built changes to these. Delivery of as-built prints and reproducibles is a condition of final acceptance.

1.8 GUARANTEE

A. Guarantee work for 1 year from the date of final acceptance of the project, and during that period make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship. Coordinate requirements for Warranty with Division 01.

1.9 SERVICE

A. Perform service work required during the guarantee period including lubrication of bearings. Perform service monthly, and provide the Owner with a written report. Cleaning of air filters and pipe strainers is not included.

1.10 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with
latest editions (except where specified otherwise in individual sections), revisions, amendments or supplements in effect on date bids are received.

1. Requirements in reference specifications and standards are minimum for all equipment, material and work.
2. In instances where capacities, size or other feature of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

1.11 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 Architect/Engineer.
2. Impact-type equipment shall not be used except where specifically acceptable to the Architect/Engineer.
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 under the appropriate Specification Section 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 Architect/Engineer.

E. Special Note: No cutting, boring, or excavating which will weaken the structure shall be undertaken.

1.12 EXCAVATION, TRENCHING AND BACKFILL

A. Excavation: See Divisions 00, 01, and 31 for special requirements related to excavation and trenching.

B. The Mechanical and Electrical subcontractors shall perform all excavations of every description, for their particular installations and of whatever substances encountered, to the depths indicated on the Drawings and/or required for the installation of piping, conduit, utility systems, etc.

C. All exterior lines shall be installed with a minimum cover of 24 inches, unless otherwise indicated.
1. Generally, more cover shall be provided if grade will permit.
2. All excavation materials not required for backfill or fill shall be removed and wasted as acceptable to the Construction Inspector.
3. All excavations shall be made only by open cut. The banks of trenches shall be kept as nearly vertical as possible and where required, shall be properly sheeted and braced.

4. Trenches shall be not less than 12 inches wider or more than 16 inches wider than the outside edges of the pipe to be laid therein, and shall be excavated true to line so that a clear space not less than 6 inches or more than 8 inches in width is provided on each side of the pipe.

5. For sewers, the maximum width of trench specified applies to the width at and below the level may be made as wide as necessary for sheeting and bracing, and the proper installation of the work.

D. The bottom of trenches shall be accurately graded to provide proper fall and uniform bearing and support for each section of the pipe on undisturbed soil or 2" of sand fill at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints.

E. Bell holes shall be dug after the trench bottom has been graded.
   1. Where inverts are not shown, grading shall be determined by the National Plumbing Code for the service intended and the size used.
   2. Bell holes for pipe joints shall be 12 inches in depth below the trench bottom and shall extend from a point 6 inches back of the face of the bell.
   3. Such bell holes shall be of sufficient width to provide ample room for caulking.
   4. Bell holes for sewer tile and water pipe shall be excavated only to an extent sufficient to permit accurate work in the making of the joints and to ensure that the pipe, for a maximum of its length, will rest upon the prepared bottom of the trench.
   5. Depressions for joints other than bell-and-spigot shall be made in accordance with the recommendations of the joint manufacturer for the particular type of joint used.
   6. In general, grading for electrical ductbanks and conduits shall be from building to manhole, and from a high point between manholes to each manhole.
   7. Special pipe beds shall be provided as specified hereinafter.

F. The lower 4" of the pipe trenches measuring from an overhead line set parallel to the grade line of the sewer shall be excavated only a few feet in advance to the pipe laying, by men especially skilled in this type of work.
   1. Where damage is likely to result from withdrawing sheeting, the sheeting shall be left in place.
   2. Except at locations where excavation of rock from the bottom of trenches is required, care shall be taken not to excavate below the depths required.
   3. Where rock excavation is required, the rock shall be excavated to a minimum overdepth of 6 inches below the trench depths specified.
   4. The overdepth rock excavation and all excess trench excavation shall be backfilled with sand.
   5. Whenever wet or otherwise unstable soil incapable of properly supporting the pipe is encountered in the trench bottom, such soil shall be removed to a depth and for the trench lengths required, and then backfilled to trench bottom grade, as hereinafter specified, with sand.

G. All grading in the vicinity of excavation shall be controlled to prevent surface ground water from flowing into the excavations. Refer to appropriate Sections of Division 31.

H. All shoring and sheeting required to perform and protect the excavations and to safeguard employees and/or adjacent structures shall be provided. Refer to appropriate Sections of Division 31.
I. Excavate as required under the building in order that all piping, ductwork, etc., shall clear the ground a minimum of 12 inches for a distance of 24 inches on either side. Edges of such excavations shall slope at an angle of not over 45° with the horizontal unless otherwise approved by the Construction Inspector. The bottom of such excavation shall be graded to drain in a manner acceptable to the Construction Inspector.

J. Trenches for cast iron drain, storm water, and sewer lines inside the building shall be properly excavated, following, in general, the procedures set out for exterior lines. Where floors are to be poured over these lines, they shall be backfilled, tamped, and settled with water. Where no flooring is to cover the lines, they shall be backfilled to form a level grade.

K. All surplus materials removed in these trenching operations becomes the property of the contractor, and shall be disposed of at the expense of the contractor, at a legal disposal site.

L. Backfilling:
   1. Trenches shall not be backfilled until all required tests are performed and until the piping, utilities systems, etc., as installed are certified by the Owner's inspector to conform to the requirements specified hereinafter. The trenches shall be carefully backfilled with sand to a depth of 12 inches above the top of the pipe. Refer to appropriate Sections of Division 31 for additional requirements.
   2. Backfill under concrete slabs-on-fill shall be as per appropriate Sections of Division 31.

M. Opening and Reclosing Pavement and Lawns: Where excavation requires the opening of existing walks, streets, drives, other existing pavement, or lawns, such surfaces shall be cut as required to install new lines and to make new connections to existing lines. Refer to Division 31. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished.

N. Excavation in Vicinity of Trees: Refer to Division 31.

O. Welding Certificates: Provide current welding certificates.

1.13 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 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.
PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Furnish new and unused materials, pipes, pipe fittings, and equipment of domestic manufacturer where available. Where two or more units of same type or class of equipment are required, provide units of a single manufacturer.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are listed in individual Sections of Division 22. Manufacturer's names and catalog numbers specified under Sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a manufacturer named in the acceptable manufacturer's list will be accepted upon approval.

B. Substitutions:
   1. If the Contractor desires to substitute a material or method as an equal to the specified item, he shall request permission from the Architect/Engineer, in writing, and shall include such literature, samples, etc., deemed necessary to establish the equal quality of his proposal.
   2. If the Architect/Engineer deems it necessary in order to establish the equality between two or more products, he may require laboratory testing at the Contractor's expense in order to obtain information upon which to base a decision.
   3. The Architect/Engineer will not give approval to material salesmen or subcontractors and only in writing to the successful Contractor after the project has been awarded.
   4. For each proposed substitution product, clearly show how the proposed product meets the requirements of the specifications, including performance.
   5. No substitution will be considered unless it is presented in writing within that number of days after Notice to Proceed equal to 15 percent of the contract time.
   6. Proposers of substitute products shall present samples, literature, test and performance data, record of other installations, names of Owners, architects, engineers, contractors and subcontractors as references, statement of current financial condition, and other technical information applicable to their products, to aid in determining the worth of the substitute product offered in relation to the material and work specified from the standpoint of the Owner's best interest.
   7. Substitute materials and products shall be used only if approved in writing by the Architect/Engineer in advance.
   8. Approval of substitute materials offered shall not be a basis for contingent extra charges because of changes in other work or related work, such as roughing-in, electrical, structural, or architectural, which may result from the substitution.
   9. For any Contractor initiated substitutions or changes, Contractor shall be responsible for achieving results equal to or better than the product or design originally specified.

2.3 PIPE STRainers

A. Immediately prior to final acceptance of project, inspect, clean and service piping system strainers.

B. Turn over to Owner additional sets of spare parts as specified.
2.4 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials and adhesives incorporated in this project shall conform to NFPA Standard 255, "Method of Test of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

2.5 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.

2.6 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8” Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, 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 or BAg1, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12.

F. 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.

2.7 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°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°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°F.

2.8 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Stainless steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.9 SLEEVES

A. Through Floors: Galvanized schedule 40 steel pipe sleeve with water ring, as detailed.

B. Through Walls in Crawl Space: Galvanized schedule 40 steel pipe sleeve with water ring, as detailed.

C. Sleeves Through Interior Walls: 22 gauge galvanized steel snap lock. No screws through vapor barrier.

2.10 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.
2.11 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 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.

M. Install sleeves for pipes passing through concrete and masonry walls, 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” 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 for roughing-in requirements.

S. Provide fire rated type access panels in fire rated walls where indicated in drawings. Access panel to match or exceed to wall rating.

3.2 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.

3.3 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.

3.4 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.
3.5 OBSTRUCTIONS

A. Drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.

B. Before any cutting or trenching operations are begun, verify with Owner's Representative, utility companies and other interested parties that all available information has been provided. Verify locations given.

C. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

D. Assume total responsibility for and repair any damage to existing utilities or construction.

3.6 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment and piping are specified under other divisions. However, drawings and layout work for exact size and location of all such openings are included under this division.

3.7 PROTECTION

A. Adequately protect work, equipment, fixtures and materials from damage during storing, installation, start-up and testing.

B. Cover all equipment stored exposed to elements with waterproof tarps. Provide adequate ventilation. At work completion, all work must be clean and in like new condition.

C. Storage of all mechanical equipment and piping materials shall be in strict accordance with manufacturers written installation instructions.

D. Provide factory installed pipe caps for all pipes to be installed on the project.

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 concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install 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.

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 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing 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 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 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 LUBRICATION AND OIL

A. Provide a complete charge of correct lubricant and/or oil for each item of equipment requiring lubrication.
3.13 TEMPORARY CONDITIONING OF BUILDING SPACES FOR COMPLETION OF CONSTRUCTION

A. All equipment utilized will be checked out by a factory representative, serviced, lubricated, checked for rotation, pressure, amp draw and vibration isolation, adjusted and certified. Record of this service must be provided monthly to the Owner. Submit appropriate reports to the University prior to submitting a written request for service.

B. All equipment operated shall be serviced on a regular basis by the Contractor.

C. Prior to final inspection, clean all equipment inside and out to a like new condition, remove temporary filters, install new permanent filters in preparation for final inspection by Owner.

D. All warranties will be commenced at the time of final acceptance.

3.14 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation witnessed by Owner's Representative.

B. Prove operations of control systems and all safeties, and alarms. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual Sections.

C. Functional Performance Testing is part of the Commissioning Process. Functional performance testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 9113, General Commissioning, for functional performance testing and commissioning requirements.

3.15 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall furnish five copies of commercially available standard operation and maintenance data, including operating instructions, maintenance instructions and parts listings. Detailed requirements for these items are as follows:

1. Information required for the preparation of O&M manuals may be furnished in the form of manufacturers' standard brochures, schematics, and other printed instructions. Clearly distinguish between information which applies to the equipment and information which does not apply. Data shall include as a minimum the following items:

2. Recommended procedures and frequencies for preventive maintenance; inspection, adjustment, lubrication, cleaning, etc.

3. Special tools and equipment required for testing and maintenance.

4. Parts lists reflecting the true manufacturer's name, part number and nomenclature.

5. Recommended spares by part number and nomenclature and spare stocking levels.

6. Integrated mechanical and electrical system schematics and diagrams to permit operation and troubleshooting after acceptance of the system.

7. Troubleshooting, checkout, repair and replacement procurement procedures.

8. Operating instructions including start up and shutdown procedures.

9. Safety considerations including load limits, speed, temperature and pressure.

10. Provide O&M manuals for all plumbing equipment. Coordinate requirements for O&M Manuals with Division 01.
3.16 OPERATING INSTRUCTIONS

A. Upon completion of work, and at time designated by the Owner's Representative, provide services of a competent representative of the Contractor for a period of at least 40 hours to instruct the Owner's Representative in the operation and maintenance of the entire system. The training sessions will be videotaped for instructing future technicians.

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. Refer to Section 019113, General Commissioning, for contractor training requirements.

C. Coordinate requirements for training with Division 01.

END OF SECTION
SECTION 22 0526

PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for pipe and pipe fittings for all piping systems. This Section applies to all Plumbing Sections of Division 22 which employ pipe and pipe fittings. Fabricate and erect all piping in accordance with ASME/ANSI B31.9 except as otherwise indicated.

1.2 RELATED SECTIONS

A. Division 07 – Thermal and moisture protection for firestopping requirements.
B. Division 09 – Finishes for painting requirements.
C. Section 22 0500 – Common Work Results for Plumbing
D. Section 22 0553, Identification for Plumbing Piping and Equipment.
E. Section 22 0548, Vibration Isolation for Plumbing Piping and Equipment.
F. Section 22 0716, Plumbing Equipment Insulation.
G. Section 22 1116, Domestic Water Piping.
H. Section 22 1119, Domestic Water Piping Specialties.
I. Section 22 1423.13, Roof Drainage Piping Systems.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 paragraphs where titles below introduce lists or manufacturers, the following requirements apply to product selection:
   1. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the manufacturer specified.

2.2 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the Section for that system. All piping and fittings shall be of U.S. Manufacturer. All pipe shall be shipped capped. Shipped and store on job site with ends capped from the factory.

2.3 JOINTS

A. Screwed: Make screwed joints using machine-cut ANSI taper pipe threads. Apply a suitable joint compound, such as Teflon tape, to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. Dissimilar Metals: Make joints between copper and steel pipe and equipment along with steel pipe and ductile iron pipe using insulating unions such as Crane Company No. 1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.

C. Solder Joints:
   1. Prior to making joints, cut pipe square and ream to full diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
   2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
   3. Utilize lead free solder. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping.

D. Welded Joints:
   1. Make welded joints as recommended by the standards of the American Welding Society.
   2. Ensure complete penetration of deposited metal with base metal.
   3. Provide filler metal suitable for use with base metal.
   4. Keep inside of fittings free from globules of weld metal.
   5. Do not use mitered joints.
   6. Use standard weld elbow fittings for changes of direction or cut a standard elbow for odd angles.

E. Flanged Joints:
   1. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64 inch per foot inclination of the flange face from true alignment.
   2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
3. Install proper gaskets, suitable for intended service and factory cut to proper dimensions. Red rubber gaskets are not acceptable. Garlock gaskets or EPDM shall be used. Apply non-stick clean surface lubricant coating to both sides of gaskets.

4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use Coreten or galvanized steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets. Use anti-seize compound on all bolts above and below grade. Bolt threads not to protrude more than 2 threads past nut.

5. Use carbon steel flanges conforming to ANSI B16.5 with materials conforming to ASTM A 105, Grade II or ASTM A 108, Grade II. Use welding neck type flanges at all fittings and on all pipe.

6. Flanges for ductile iron pipe are specified in Sections using that pipe.

7. Keep flange covers on equipment and shop-fabricated piping until ready to install in system.

F. No Hub: Install according to manufacturer's recommendations, using recommended tools.

G. Bell and Spigot: Use neoprene compression gaskets for sanitary and storm.

H. Push-on Joints (Ductile Iron Pipe): Restrained joints and gaskets for ductile iron pipe are specified in Sections using that pipe.

2.4 UNIONS

A. Use 150-pound standard (300-pound WOG) malleable iron, ground joint unions with bronze seat. Provide flanged union joints on piping larger than 2-1/2 inches.

2.5 BRANCH CONNECTIONS

A. For Pipe 2 inches and smaller, use threaded fittings for steel pipe. For threaded piping, use straight size of reducing tee.

B. For 2-1/2 Inches through 14 Inches: For welded piping, when branch size is the same as and one size smaller than header size, use welding tee. Use Weld-O-Let when branch is two or more sizes smaller than header. For threaded branch connections, use thread-o-let welded to header.

C. All 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 system piping will cause that section of the piping to be cut out and replaced at the Contractor's expense.

2.6 GASKETS

A. Provide gaskets between flanges of all flanged joints. Inside diameter of gaskets shall conform to nominal pipe size. Gaskets shall be ring type between raised face flanges and full face between flat face flanges with punched bolt holes and pipe opening.
B. Gaskets shall be cut from 1/8 inch thick non-metallic, non-asbestos gasket material suitable for operating temperatures from -150°F to +750°F. Garlock or equal. For pipe smaller than 6 inches, use 1/16-inch-thick gasket.

2.7 FLOOR AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view and passing through walls, floors, partitions, or ceilings in finished areas. Size plates to fit pipe or insulation and securely lock in place.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work.

B. Give particular attention to piping in the vicinity of equipment. Preserve the maximum access to various equipment parts for maintenance. Install piping plumb and parallel with building walls.

C. Do not cut or weaken any structural member.

D. Cut all pipes accurately to measurement determined at the site. After cutting pipe, ream it to remove burrs.

E. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make all changes in direction. Field bending and mitering are prohibited. Make all connections to equipment using flanged joints or unions. Make reducing connections with reducing fittings only.

F. All water piping installed above ground or below ground and in trenches, including preinsulated piping, must be installed by a licensed Mechanical Contractor at building rates. The wage rates for building trades apply only to the extent of work required to be installed by licensed Plumbing or Mechanical Contractors.

3.2 WELDING

A. Weld and fabricate piping in accordance with ANSI Standard B31.9, latest edition, Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.

B. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, valves or equipment.

3.3 OFFSETS AND FITTINGS

A. Because of the small scale of Drawings, the indication of all offsets and fittings is not possible. Carefully investigate the structural and finish conditions affecting the work and take such steps as may be required to meet such conditions.

B. Install all piping close to walls, ceilings, and columns so piping will occupy the minimum space. Provide proper space for covering and removal of pipe, special clearances, and for offsets and fittings.

3.4 PIPE SLEEVES

A. Fit with sleeves all pipes passing through gyp board, masonry, and concrete construction, refer to specification section 22 0500 and the following:

1. Provide 22 gauge wall sleeves for pipes passing through gyp board walls.

2. Fabricate floor sleeves of schedule 40 weight galvanized steel pipe, and masonry wall sleeves of 40 gauge galvanized steel.

3. Size sleeve for minimum clearance between pipe or insulation and sleeve.

4. All floor sleeves in wet lab areas to have a welded waterstop.

5. All sleeves shall be hot dipped galvanized after fabrication.

B. Extend each sleeve through the floor or wall. Cut the sleeve flush with each surface, except that in exposed locations, extend floor sleeves 2 inches above finished floor line.

C. Seal all sleeves water and airtight. Seal annular space between pipes and sleeves with compound with flame and smoke spread rating of minimum 25/50 in accordance with ASTM E 84 test.

D. Sleeves below grades in outside walls are detailed on drawings. Except as shown otherwise, provide Thunderline Link-Seal or approved equivalent with stainless steel nuts and bolts, with cast iron pressure plate.

3.5 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections at each floor and at branch takeoffs serving all equipment, and at other locations as indicated and required for isolation of piping or equipment.

3.6 DRAIN VALVES AND VENTS

A. Install drain valves at all low points and at base of all risers of water piping systems so that these systems can be entirely drained. Install a 2 inch drain for 2-inch pipes and larger. Install a line size drain valve for pipes smaller than 2 inches. Provide hose adapter and cap on all drain lines.
B. Provide automatic vents with isolation valves or manual vents at locations as indicated on drawings and all high points in piping systems.

3.7 CLEANING OF PIPING SYSTEMS

A. Cleaning of piping system must be performed by an independent agency specializing in this type of work:
   1. The agency must have a minimum of 5 years experience with at least three projects of similar size.
   2. Submit project names for review.

B. Minimum velocity of 10 feet per second must be maintained in the pipes during flushing period:
   1. Do not use building pumps for circulating water.
   2. Provide temporary pumps as required to achieve minimum velocities.
   3. Remove flow meters from building piping during flushing operation.
   4. Provide means (instrumentation) during flushing period to prove to the Owner that the minimum velocities are maintained in the pipes.

C. Submit a detailed plan for the Engineer's and Owner's review and approval describing in full detail the individual steps associated with this process before any piping is installed:
   1. Plan must include a drawing indicating GPM's required to provide minimum velocity required in the piping, phasing of systems being cleaned, locations of drains or other temporary connections required for cleaning system, and cutsheet of temporary pump proposed.

D. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the systems in service. Provide temporary connections and valves as required for cleaning, purging and circulating.

E. Install temporary strainers in front of pumps, tanks, water still, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blowoff valve.

F. Domestic Water Piping:
   1. All potable water piping and tanks shall, after successful pressure testing, be thoroughly flushed with clear water and then sterilized.
   2. Sterilization shall be with either liquid chlorine or chlorine gas of adequate volume to give a concentration of 50 ppm based upon the volume of the system being treated.
   3. The solution will be allowed to stand for a period of 24 hours.
   4. A minimum residual chlorine level of 5 ppm shall remain in each system for a minimum of 24 hours.
   5. After sterilization, all piping shall be thoroughly flushed.
   6. The above are minimum requirements and all sterilization procedures shall be in strict accordance with all local codes and authorities having jurisdiction.
   7. Under no circumstances shall the Contractor permit the use of any portion of the domestic water system until it has been properly sterilized and certified by the authorities having jurisdiction.

G. Special requirements, if any, are specified in the Sections for each type of piping.
H. After systems have been flushed, cleaned and sterilized; as required by specifications, provide written certification from the cleaning contractor that the systems are clean and ready for use.

3.8 LEAK TESTS

A. All piping systems shall demonstrate leak tightness. This requirement shall be met by a water hydrostatic leak test or a pneumatic leak test, whichever is called for under specific piping Sections.

B. Piping Systems:
1. Test Preparation: Expansion joints shall be provided with temporary restraint, for the additional pressure load under test or shall be isolated from the test. Equipment and valves which are not rated for the pressure test shall be either disconnected from the piping or isolated by a blind flange or similar means.
2. Test Pressure: The water hydrostatic test pressure shall be 1.5 times the design pressure. The pressure test shall be maintained for sufficient time to inspect all joints, with a minimum time of four hours.
3. Special requirements, if any, for each system are specified in the Section for that system.

3.9 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

A. Provide service connections to items of equipment furnished by others:
1. Detailed shop drawings of equipment will be furnished indicating the exact number and location of rough-in points.
2. Such final shop drawings may indicate adjustments in total number and exact location of rough-in points, and in equipment dimensions.
3. Making adjustments to field conditions is considered a part of the work required.

B. Roughing-In:
1. When roughing-in, extend service piping to various items of equipment.
2. Temporarily terminate at proper points as indicated on detailed equipment shop drawings or as directed.
3. Do not use contract drawings accompanying these specifications for rough-in locations but only for pipe sizing and general routing.

C. Stop Valves:
1. Provide stop valves for each service at rough-in locations, except for drains.
2. Stop valve locations are subject to approval, and in all cases must be accessible from the same room in which the furniture or equipment is located.

3.10 TEMPORARY CONDITIONING OF BUILDING SPACES FOR COMPLETION OF CONSTRUCTION

A. Refer to Specification 22 05 00, Common Work Results for Plumbing, for requirements that must be completed prior to requesting the Owner to provide chilled water or hot water from the building distribution system.
3.11 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. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Division 03 Section, Concrete, for concrete requirements.

C. Division 05 Section, Metal Fabrications, for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

D. Division 09 Section, Painting, for painting requirements.

E. Section 21 1300, Fire-Suppression Systems, for pipe hangers for fire-suppression piping.

F. Section 22 0500, Common Work Results for Plumbing

G. Section 22 0548, Vibration Isolation for Plumbing Piping and Equipment, for vibration isolation devices.

1.2 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes 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.
1.4 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Metal framing systems. Include Product Data for components.
   3. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Anvil
B. Cooper B-Line
C. Erico
D. Unistrut
E. Nibco
F. PHP

2.2 CLEVIS TYPE HANGERS

A. Adjustable steel clevis hangers (MSS1 Type 1), similar to Anvil Figure 260.

2.3 METAL FRAMING SYSTEMS

A. Provide fabricated cadmium plated steel framing members and appurtenances for interior pipe supports as shown:
   1. Mult-A-Frame, Unistrut, Cooper B-Line and Power-Strut pipe support systems also are acceptable.
   2. Support piping from precast and pan joist structure as detailed on Drawings.
3. Powder actuated anchors are not permitted.
4. Sleeves penetrating beams must be submitted through Structural Engineer. Refer to plumbing drawings for locations.

B. Framing channel type support systems shall be 12-gauge cold-formed carbon steel conforming to ASTM A570 GR33:
1. Fittings for framing channel system shall be punch pressed electro-galvanized carbon steel conforming to ASTM A575, A576, A635 and A36.
2. Bolts and nuts shall have unified coarse screw threads with standard 1/2 inch nuts, conforming to ASTM A576 GR1015 AND ASTM A307.
3. Components shall have an electro-plated zinc coating conforming to ASTM B633 SC1 or SC3, except where outdoors where a hot dipped galvanized coating conforming to ASTM A123 shall be used.

2.4 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.

2.5 THERMAL-HANGER SHIELD INSERTS
A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.
B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier with vapor barrier.
C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS
A. 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.

2.7 EQUIPMENT SUPPORTS
A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.
2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Concrete: Provide 3,000 psi concrete. Reinforce slab with No. 4 rebar on 12 inch center each way centered in slab unless indicated otherwise on Drawings.

C. 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.

2.9 SUPPORTS AND HANGERS WITHIN WALLS AND CHASES

A. Where plumbing piping is located in walls and chases it shall be supported and clamped with factory supplied commercial support assemblies, inserts and clamps as manufactured by Holdrite, or approved equal.

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. Metallic coatings for piping and equipment that will not have field-applied finish. All hangers and supports shall be electro-plated zinc per ASTM B633 SC1 or SC3, except hangers, framing channels, supports and other associated hardware in crawl space shall be hot dipped galvanized conforming to ASTM A123.

D. Use 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. 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.

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°F to 450°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. 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.
   8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

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. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
   3. 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.

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 mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. All exposed hangers and supports within areas with wash down hoses and areas where washdown can occur, shall have a hot dipped galvanized finish.

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 herein 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.

E. Fastener System Installation:
   1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer’s written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


H. Install hangers and supports to allow controlled thermal 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.
M. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. 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.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
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.

N. Do not support piping from other piping.

O. Where uninsulated (bare) copper pipe is supported by clevis hangers and riser clamps. The hangers shall be plastic coated or copper.

P. Where uninsulated (bare) copper pipe is clamped to a dissimilar metal, such as steel, the copper pipe shall be installed with a felt isolator or Vibra Cushion No. B1999 manufactured by B-Line, Erico “Caddy” Cushion Clamp, or approved equal.

Q. Isolation tape wrap is only acceptable where a clamp or support does not occur and where pipe is in connect with a building element.

R. Place hangers not more than 6 feet apart on 1/2 inch and 3/4 inch pipes, or 10 feet apart on larger pipes unless noted otherwise on plans. Place hangers not more than 6 feet apart for all sizes of polyvinyl chloride pipe. Refer to manufacturer’s recommendations for supporting polypropylene piping. For copper piping, place hangers as follows:
   1. For sizes up to 1 inch – maximum 5 feet - 0 inches O.C.
   2. For sizes 1-1/4 inch to 1-1/2 inch – maximum 7 feet - 0 inches O.C.
   3. For sizes 2 inches to 3 inches and larger – maximum 9 feet - 0 inches O.C.

S. Support vertical risers as detailed on drawings at every floor:
   1. All water piping 2 inches or smaller shall be supported with galvanized steel strap pipe clamps of approved designed and sizes, properly supported at every floor.
   2. Support piping assemblies in chases adequately enough to be rigid and self-supporting before the chase is closed.
   3. Provide adequate structural support for piping penetrating chase walls to fixtures.

T. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation Section.
U. Perforated bar hangers, straps, wires or chains are not permitted.

V. For cast iron piping, refer to specification section 22 1316.

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.

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.

3.6 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. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
SECTION 22 0553
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 Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. Warning tags.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples: For color, letter style, and graphic representation required for each identification material and device.
C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
D. Valve numbering scheme.
E. Valve Schedules: For each piping system to include in maintenance manuals.

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 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of
the following:
1. Brady Corporation.
2. Marking Services, Inc.

2.2 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving,
   1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Background to contrast with letter color.
4. Maximum Temperature: Able to withstand temperatures up to 160°F.
5. Minimum Label Size: Length and width vary for required label content, but not less than
   4 inches wide X 1-1/2 inches high.
6. 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.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number,
   Drawing numbers where equipment is indicated (plans, details, and schedules), plus the
   Section number and title where equipment is specified.

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.

2.3 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16
   inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Background to contrast with letter color.

D. Maximum Temperature: Able to withstand temperatures up to 160°F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2
   by 3/4 inch.
F. 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.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
   2. Paint: Standardized colors for the piping systems shall be per Division 09 painting specification. Paint material is based on colors and model numbers manufactured by Glidden unless otherwise indicated. Subject to compliance with requirements, provided named color or comparable product as approved. Use the following colors for banding of all piping and conduit:

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water, Cold, Hot or Hot Water</td>
<td>Blue, comparable to ICI/Glidden #1330</td>
</tr>
<tr>
<td>Return, RO Water</td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Yellow (Paint entire pipe)</td>
</tr>
<tr>
<td>Fire</td>
<td>Red</td>
</tr>
<tr>
<td>Compressed Air, Vacuum, Oxygen, Nitrogen</td>
<td>White</td>
</tr>
<tr>
<td>Fire Water</td>
<td>Red</td>
</tr>
<tr>
<td>Drain Lines</td>
<td>Black, comparable to ICI/Glidden #1484</td>
</tr>
</tbody>
</table>

B. Standardized Sizes: Tags shall be at least 1-1/2 inches in diameter, with depressed block characters 1/4 inch high. Titles shall be lettered on bands. Uppercase letters and Arabic numerals shall be used. Where pipes or conduits are too small or not readily accessible for such application securely fasten a brass identification tag at appropriate locations. Identification of the material contained in piping and conduits in accordance with the table below:

<table>
<thead>
<tr>
<th>BAND AND LETTER SIZE ALL DIMENSIONS IN INCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Diameter of Pipe Covering</td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>1/2 to 1-1/4</td>
</tr>
<tr>
<td>1-1/2 to 2</td>
</tr>
</tbody>
</table>
1. Pipe Identification: Identify pipe at wall penetrations, machine or tank connections, and at not over 50 foot intervals. Marker identification shall be legible and should be visible from the floor. Stick-on type or plastic wrap-on markers are not acceptable. Mark each pipe circuit with stencil. Stencil shall include flow arrow and identification marks as follows:

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water Supply</td>
<td>Dom-W-S</td>
</tr>
<tr>
<td>Domestic Hot Water Return</td>
<td>Dom-HW-R</td>
</tr>
<tr>
<td>Domestic Hot Water Supply</td>
<td>Dom-HW-S</td>
</tr>
<tr>
<td>Condensate Drainage</td>
<td>Cond Drain</td>
</tr>
<tr>
<td>Storm Sewer</td>
<td>Storm</td>
</tr>
<tr>
<td>Overflow Drain</td>
<td>Overflow</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>San</td>
</tr>
<tr>
<td>Sanitary Vent</td>
<td>San-V</td>
</tr>
<tr>
<td>Compressed Air (100 psi)</td>
<td>Air-100 psi</td>
</tr>
<tr>
<td>Medical Air</td>
<td>Med-Air</td>
</tr>
<tr>
<td>Lab Vacuum</td>
<td>Lab-Vac</td>
</tr>
<tr>
<td>Medical Vacuum</td>
<td>Med-Vac</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N2</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O2</td>
</tr>
<tr>
<td>Vacuum Cleaning</td>
<td>Vac Clean</td>
</tr>
<tr>
<td>RO Water Supply</td>
<td>RO-W-S</td>
</tr>
<tr>
<td>RO Water Return</td>
<td>RO-W-R</td>
</tr>
<tr>
<td>Acid Waste</td>
<td>Acid-W</td>
</tr>
<tr>
<td>Acid Vent</td>
<td>Acid-V</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Nat-Gas</td>
</tr>
</tbody>
</table>

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4 inch letters for piping system abbreviation and 1/2 inch numbers.
   1. Tag Material: Brass, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass S-hook.

B. Valve Schedules: For each piping system, on 8-1/2 X 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.
2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 X 5-1/4 inches minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Equipment to be identified with plastic nameplates includes but is not limited to water heaters, filters, plumbing equipment, tanks, and water treatment devices.

B. Identify small devices, such as in-line pumps with metal tags.

C. Identify valves with tags.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 painting sections

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
   1. Identification Paint: Use for contrasting background.

C. 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 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

3.5 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.
B. List tagged valves in a valve schedule in aluminum frame with clear plastic shield. Install at location as directed by Owner’s Representative.

3.6 WARNING-TAG INSTALLATION
A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION
SECTION 22 0719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:
1. Insulation Materials:
   a. Fiberglass insulation.
2. Sealant, adhesives and finishes.
3. Jackets:
   a. PVC jackets.
   b. Canvas or glass jackets.
   c. Aluminum type jackets.

B. Related Sections include the following:
1. Section 22 0500, Common Work Results for Plumbing
2. Section 22 0529, Hangers and Supports for Plumbing Piping and Equipment.
3. Section 22 0534, Domestic Hot Water Maintenance Tracing
4. Section 22 1116, Domestic Water Piping Systems
5. Section 22 1316, Sanitary Waste and Vent Piping
6. Section 22 1423.13, Roof Drainage Piping Systems

1.2 REFERENCES


1.3 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thicknesses for equipment scheduled.

B. Shop Drawings:
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.
   8. Detail field application for each equipment type.

C. Samples: Submit samples of each type of insulation to display the material, quality, and application method.
   1. Obtain approval of sample application before proceeding with work.

D. Manufacturer’s Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

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. Surface Burning Characteristics: Flame spread/smoke developed index of 25/50 maximum when tested in accordance with ASTM E 94, NFPA 255, or UL 723.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified with minimum 5 years experience.

C. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer’s identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.
1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 INSULATION

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CertainTeed Corp.
   2. Johns Manville.
   4. Owens Corning.
   5. Foster
   6. Childers

B. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

C. Insulation Type A: Fiberglass Insulation to comply with ANSI/ASTM C 547 with k factor of 0.23 BTU/ft²/F/hr/inch at 74°F.
   1. Minimum 5-pound density insulation.
   3. Additionally provide hard aluminum metal jacket or reinforced aluminum foil jacket where indicated herein.

2.2 SEALANT, ADHESIVE, AND FINISH

A. Acceptable Manufacturer: Subject to compliance with requirements, provide products manufactured by Foster or Childers Products, unless otherwise specified.

B. Fiberglass – Low Temperature (below 100°F):
   1. Sealant: Childers CP-76 or Foster 95-44 elastomeric sealant at valve covers, anchors, and hangers.
   2. Adhesive: Childers CP-82 or Foster 85-20/85-60 adhesive to seal longitudinal laps of the vapor barrier jacket and to adhere butt joint covers.
   3. Finish: Childers CP-34 or Foster 30-65 vapor barrier coating and Childers Chil Glas No. 10 glass or Foster Mast a Fab polyester cloth.

C. Fiberglass – High Temperature (above 100°F):
   1. Adhesive: Childers CP-82 or Foster 85-20/85-60 adhesive to seal longitudinal laps of the vapor barrier jacket and to adhere butt joint covers.
   2. Finish: Childers CP-10/11 or Foster 46-50 breather master with Childers Chil Glas No. 10 glass or Foster Mast a Fab polyester cloth.
3. Cement: Ryder One Coat on insulated fittings, flanges, and valves.
4. Piping: Childers CP-50AMV1 or Foster 81-42/30-36 lagging adhesive diluted 50% to prime dusty surfaces (calcium silicate or mineral fiber) prior to applying breather mastic.

2.3 JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
B. Canvas or Glass Jackets, Indoor Only: UL listed cotton fabric, 6 ounce/square yard or low odor glass cloth, Childers 50AMV1 or Foster 81-42/30-36 lagging adhesive or approved equal.
C. Hard Aluminum Metal Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
   1. Piping: Prefabricated jacket of ASTM B 209 aluminum, 0.020 inches thick with factory applied 2 mil moisture barrier for finishing interior insulated pipe.
   2. Valves, Fittings, and Flanges: ASTM B 209 aluminum covers, 0.020 inches thick providing complete coverage of all valves, fittings, and flanges.
   3. Straps and Seals: 1 inch x 0.010 inch ASTM B 209 aluminum strapping and seals for applying aluminum jacket and covers to provide weather-tight covering of all insulation including caps, flanges, and end of lines.
D. Reinforced Aluminum Foil Jacket: Provide service reinforced vapor barrier jacket with integral laminated aluminum vapor barrier manufactured by Foster Vaporfas 62-05 or Venture Clad 1577CW.

PART 3: EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install materials in accordance with manufacturer's instructions.
B. 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.
C. 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.
D. 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.

E. Install insulation with longitudinal seams at top and bottom of horizontal runs.

F. Install multiple layers of insulation with longitudinal and end seams staggered.

G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

H. Keep insulation materials dry during application and finishing.

I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

J. Install insulation with least number of joints practical.

K. 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.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. 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.
   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.
   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.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere and seal patches similar to butt joints.
Q. For piping systems being heat traced, provide insulation one pipe size larger to accommodate the heat tracing cable.

R. 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.

S. On piping where tracing will be installed the insulation size shall be 1 pipe size larger to accommodate the heat trace cable. Strictly follow the heat tracing system manufacturer’s recommendations where insulating the piping system.

3.3 PIPING INSTALLATION

A. Complete pressure testing of piping systems prior to application of insulation.

B. Fiberglass Pipes: Butt insulation joints firmly together. Seal longitudinal laps and butt strips with sealant.

C. Fiberglass Low Temperature (below 100°F): Where piping is interrupted by fittings, flanges, valves or hangers, and at intervals not to exceed 25 feet on straight runs, form an isolating seal between the vapor barrier jacket and the bare pipe by liberal application of the sealant to the exposed joint faces carried continuously down to and along 4 inches of pipe and up to and along 2 inches of the jacket. Not required for storm piping or domestic water piping.

3.4 VALVES, FLANGES, AND FITTINGS

A. Fiberglass – Low Temperature (below 100°F):
   1. Insulate valves, flanges, and fittings with fiberglass blankets.
   2. Finish with 1/4-inch layer of Foster 30-65 or Childers CP-34 reinforced with Foster Mast a Fab or Childers Chil Galss No. 10 glass/polyester fabric.

B. Fiberglass – High Temperature (above 100°F):
   1. Omit insulation at screwed unions and at valves smaller than 1-1/2 inches.
   2. On concealed (other than mechanical and pump rooms) piping, insulate fittings and valves 2-1/2 inches IPS and larger, with fiberglass blankets. Thickness of insulation shall be equal to that of adjoining pipe. Finish with coating reinforced with white 10 inch x 10 inch glass fabric.
   3. On concealed piping, insulate fittings and valves 2 inches IPS and smaller with mineral wool and insulating cement to a thickness equal to or greater than adjoining straight pipe. At Contractor’s option, provide molded or mitered fittings, finished with Foster 46-50 or Childers CP-10/11 breather coating reinforced with glass fabric.
   4. In exposed (mechanical, pump and equipment rooms) area, insulate all fittings, flanges and valves with molded or mitered fitting covers. Thickness of insulation shall be equal to that of adjoining pipe. Finish with breather coating reinforced with white glass fabric.
3.5 CONTROL VALVE COVERS - LOW TEMPERATURE SERVICE ONLY

A. Fabricate special covers, complete with troweled-on vapor seal, shaped to accommodate the valve stem. Insulation thickness shall be same thickness as adjoining pipe.

B. Seal covers to valve insulation proper with adhesive so that the seal may be broken with a knife blade without damage to either part. Arrange so that cover can be removed and replaced as necessary for operation of the valve. Finish valve cover with glass cloth and two coats of finish.

3.6 SHIELDS AND HANGERS

A. Where piping hangers or anchors must be in direct contact with pipe, seal off the pipe insulation on both sides of the hanger by carrying the vapor seal down to the bare pipe.

1. Apply insulation around the hanger ring or anchor and pipe and carry vapor barrier upward and outward along the hanger rod or anchor members to a point not less than 12 inches from the adjacent pipe.

2. Draw wire loops tight over the vapor barrier jacket, with ends of wire bent down. Take care to avoid puncturing the vapor seal.

3. Finish insulation as specified for flanges, and seal over adjacent vapor barrier jacket.

3.7 ALUMINUM TYPE JACKETING

A. Apply aluminum type jacketing jacket and covers according to manufacturer's recommendations, completely encapsulate insulation on all piping, valves, flanges, reducers, etc.

B. Hard aluminum metal jacketing shall be installed using aluminum strapping and seals to provide complete weathertight covering. Provide hard aluminum jacket for all piping in mechanical rooms and mechanical penthouses within 84-inches of finished floor.

C. Provide aluminum foil jacketing in crawl spaces and in mechanical equipment rooms and mechanical penthouses above 84" from finished floor.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. All insulation applications will be considered defective Work if inspection reveals noncompliance with requirements.
3.9 INSULATION SCHEDULE

A. Provide insulation with thickness and conductivity values in compliance with ASHRAE Standard 90.1, but not less than thicknesses scheduled below:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>PIPE SIZES</th>
<th>INSULATION THICKNESS-INCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHU Condensate Drains</td>
<td>All Sizes</td>
<td>1</td>
</tr>
<tr>
<td>All Horizontal Storm and Overflow Drain Piping, including drain bodies extending to downspout, unless otherwise noted on drawings. Insulate aboveground storm piping downstream of condensate drainage piping connecting to the storm system.</td>
<td>All sizes</td>
<td>1</td>
</tr>
<tr>
<td>All Domestic Cold Water and Domestic Hot Water serving single fixtures.</td>
<td>A</td>
<td>1/2</td>
</tr>
<tr>
<td>Domestic Hot Water Supply and Return</td>
<td>A</td>
<td>1-1/2” and smaller</td>
</tr>
<tr>
<td>Domestic Hot Water Supply and Return</td>
<td>A</td>
<td>2” and larger</td>
</tr>
<tr>
<td>Drinking Fountain Drains</td>
<td>A</td>
<td>All sizes</td>
</tr>
<tr>
<td>Floor Drain Bodies and Drain Lines receiving AHU Condensate. Insulate from floor drain to connection to storm drainage system.</td>
<td>A</td>
<td>All sizes</td>
</tr>
<tr>
<td>All Domestic Cold Water, and Makeup Water</td>
<td>A</td>
<td>All sizes</td>
</tr>
</tbody>
</table>

1. Refer to floor plans for any additional locations for insulating piping due to acoustical concerns.
2. Where hot water heat maintenance cable is installed provide insulation thickness recommended by Heat maintenance cable manufacturer. Where Tyco (Pentair) Heat Maintenance Cable is used insulate as follows: ½” copper pipe – ½” thick insulation, ¾” copper pipe – 1” thick insulation, 1” copper pipe – 1” thick insulation.
3. Insulate storm system from and including roof drain and overflow drain body extending to the vertical downspout. The storm system vertical downspouts do not need to be insulated except if a condensate drain line is connected to the storm system. Then the storm system shall be insulated entirely downstream of the condensate system line connection. The storm drain system shall also be insulated where inside the crawl space in all locations. Concealed outdoor storm piping and overflow piping and associated drain bodies shall be insulated.
4. All domestic water lines including supply lines to trench drain spray nozzles, trench drain flush valves, and trap primer lines located within crawl space shall be insulated.

END OF SECTION
SECTION 22 1116
DOMESTIC WATER PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes requirements for furnishing and installing domestic hot and cold water piping, including hot water return and filtered water within the building.

1.2 RELATED SECTIONS
A. Section 22 0553, Identification for Plumbing Piping and Equipment.
B. Section 22 0500, Common Work Results for Plumbing
C. Section 22 0719, Plumbing Piping Insulation.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Field quality-control reports.

1.4 QUALITY ASSURANCE
A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
B. Comply with NSF 14 for plastic, potable domestic water piping and components.
C. Comply with UL classified in accordance with ANSI/NSF 61 for hot and cold potable water service and shall be certified to the low lead requirements of NSF-372 for potable domestic water piping and components. Manufacturer must provide written documentation of compliance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Acceptable Manufacturers: Subject to compliance with requirements provide indicated products by manufacturers listed.
   1. Valves:
      a. Apollo.
      b. Crane.
c. Nibco.
d. Keystone.
e. Watts.
f. Milwaukee.
g. Hammond.

2. Vacuum Breakers and Backflow Preventers:
   a. Watts.
   b. Febco.
   c. Wilkins.
   d. Flomatic.

3. Expansion Tanks:
   a. Amtrol.
   b. Watts.
   c. Taco.

4. Water Meters:
   a. Rosemount

5. Thermostatic Mixing Valves:
   a. Lawler.
   b. Bradley.
   c. Powers

2.2 PIPING AND FITTINGS

A. Underground Piping:
   1. Sizes 4 inch and smaller: Provide ASTM B 88, hard-drawn, Type K copper water tube with wrought copper fittings with socket ends, ANSI B16.22. Provide Sil-Fos lead-free solder for all solder joints. Under slab (buried) trap primer piping (tubing) shall be ASTM B88 annealed type K soft copper, without joints below slab or in slab. Underground copper piping shall have a protective flexible poly material sleeve fully encasing pipe and fittings, similar to IPS Protect-O-Sleeve.

B. Aboveground (Including Trap Primer Piping): Provide seamless, ASTM B 88, Type L copper water tube with ANSI B16.22 wrought copper fittings with socket ends OR Schedule 10, ASTM A312, Type 304/304L or 316/316L stainless steel roll grooved piping with Victaulic stainless steel fittings for sizes 2 ½” and greater with grooved end ductile iron couplings as recommended by the manufacturer. Lead-free solder for all solder joints, Alloy Grade E in accordance with ASTM B32, similar to Engelhard Silvabrite 100. Joints for pipe fittings 2” and larger may be grooved type joints. Grooved End Fittings: All grooved end fittings shall be ANSI B16.18 cast bronze or ANSI B16.22 wrought copper, with copper-tube dimensioned grooved ends. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.) Couplings shall consist of two ductile iron housing segments cast with offsetting angle-pattern bolt pads, pressure responsive grade EHP gasket, and zinc-electroplated steel bolts and nuts. Couplings shall be installation-ready, for direct stab installation without field disassembly. Victaulic Style 607. Flange Adapter Victaulic Style 641 roll grooved copper-tube dimensioned fittings sized 2” and larger. 3/8” diameter copper tube is allowed only where serving a single lavatory with a 0.5
gpm flow control device. For Filtered water system (Starbuck’s RO water system) provide schedule 40 plenum rated CPVC with socket solvent cement joints.

C. Unions: ANSI B16.22 Class 150, 300-pound water-oil-gas service wrought solder joint fitting such as NIBCO 633/733 union C x C, or approved equal.
1. Flange joints larger than 2 inches shall be brass.
2. Provide dielectric isolating unions or connections between metallic piping of dissimilar metal.
3. Dielectric waterway fittings with grooved and/or threaded ends, as manufactured by Victaulic Company, Series 647, for sizes 1/2" through 8

2.3 VALVES

A. Comply with requirements in Section 22 1119, Domestic Water Piping Specialties, for balancing valves, drain valves, backflow preventers, and vacuum breakers.

B. Ball Valves (pipe sizes through 2 inches): 600 psi WOG, cast silicone bronze body, ASTM B584 Alloy C87600, two piece reinforced Teflon seats, full port, blowout proof stem, quarter turn handle with stainless steel ball and stem with threaded ends, manufactured by NIBCO No. T-585-66-LF or approved equal.

C. Check Valves:
1. 2 inches and smaller: Class 125, horizontal swing silicone bronze disc, with bodies and caps conforming to ASTM B 584 Alloy 87850 cast silicone bronze material, threaded ends, manufactured by NIBCO No. T-413-Y-LF or approved equal.
2. 2-1/2 inches and larger: Class 125, iron body, bronze mounted, with body and cap conforming to ASTM A 126, Class B cast iron, horizontal swing bronze disc, manufactured by NIBCO No. F-918-B, or approved equal.

D. Butterfly Valves (2-1/2 inch and larger): Class 150, ductile iron body conforming to ASTM A-395, fully lugged, drilled body, lever operated, blow out proof type 316 stainless steel disc and stem, EPDM seat, suitable for bi-directional dead end service with downstream flange removed, minimum 175 psi bubble tight shut-off, manufactured by NIBCO No. LD-2000, or approved equal. For grooved systems Victaulic Series 608N or NIBCO GD-4765 are acceptable.

E. Domestic Hot Water Circulation Loop Automatic Balancing Valve: Inline stainless steel, 400 psig pressure rating, NSF61-G certified, ¼" NPT, EPDM o-ring, lead free, series 300 stainless steel flow cartridge, manufactured by IMI Flow Design
1. Model ICSS075FF-1 (1 gpm on Levels 2, 3, 4, 5 and Basement)
2. Model ICSS075FF-2 (2 gpm on Level 1)

2.4 STRAINERS

A. Y type, for pipe sizes 2 inch and less, class 125 rated for working pressure through 200 psig at 200°F, threaded ends, threaded cap, ASTM B62 cast bronze body and cap, 20 mesh stainless steel screen, openings not larger than 1/32 inch, tapped blowout outlet with minimum size of 1/4 inch, similar to NIBCO No. T-221-B, or approved equal.

B. Y type, for pipe sizes over 2 inch, class 125 rated for working pressure of 200 psig at 150 degrees F, flanged ends, ASTM A126-B cast iron body, ASTM A36 carbon steel cover, non-asbestos gasket, type 304 perforated stainless steel screen, 1/16 inch perforations for pipe
2.5 VACUUM BREAKERS AND BACKFLOW PREVENTERS

A. Atmospheric Vacuum Breakers: Full line size, manufactured of brass or bronze with full size orifice, dry guide out of the liquid pressure area and disc float closing vent with minimum flow. Manufactured by Watts Regulator, No. 288A Series, or approved equal by Wilkens or Conbraco.

B. Pressure Type Vacuum Breaker: Full line size, with full size orifices, manufactured of brass or bronze with double poppit (check valve) stainless steel screen and vent. Manufactured by Watts Regulator, No. LF800M4QT, or approved equal by Wilkens or Conbraco.

C. Reduced Pressure Backflow Preventer: Size as indicated on Drawings, manufactured of bronze, rated for 175 psi, and shall include strainer, gate or ball valves based on size, pressure differential relief valve, check valves, test cocks, and relief vent and funnel drain.
   1. Unit shall meet the requirements of ASSE 1013, and AWWA, University of Southern California tested and approved.
   2. Manufactured by Watts Regulator No. 909, or approved equal by Wilkens or Flomatic.
   3. For the domestic hot water system (in Building 1814, Level 4 - Penthouse) provide a reduced pressure backflow preventer which is rated for a constant temperature of 140 degrees F and an intermittent temperature of 180 degrees F. Manufactured by Watts Regulator No. 909HW, or approved equal.

D. Vacuum Relief Valve: 3/4 inch bronze with high temperature resisting disc, and disc guide located out of water.
   1. Tested up to 200 psi and 250°F and shall be open on a vacuum of not more than 1/2 inch of mercury.
   2. Manufactured by Watts Regulator No. N36g, or approved equal by Wilkens or Conbraco.

E. Pressure Type High hazard, anti-siphon, anti-spill, vacuum breaker designed for indoor applications, featuring bronze body, one-piece modular check valve and float assembly, stainless steel springs, bronze quarter turn ball valves at inlet and discharge, University of Southern California tested and approved. Manufactured by Watts No. LF800M4QT, or approved equal by Wilkens or Conbraco.

F. Dual Check Valve: Tested and certified to meet ANSI/ASSE Standard 1024, testable, cast bronze body, silicone discs, stainless steel springs, manufactured by Watts Series L7, or approved equal.

2.6 AIR RELIEF VENTS

A. Float operated, constructed of cast iron with stainless steel float and trim and isolating valve:
   1. 1/2 inch, rated at 300 psi at 150°F.
   2. Vents shall be designed to eliminate air from the system automatically without permitting the passage of water.
   3. Minimum 3/4 inch system connection (inlet), minimum 1/2 inch drain connection (outlet), 1/4 inch drilled, tapped and plugged test connection.
   4. Manufactured by Clark-Reliance, Model No. 6-V, or approved equal.
B. For sizes under 2” (Point of Use at Equipment Connections): Automatic in operation, adjustable, renewable stainless steel seat, bronze body, adjustable from 25-75 psi outlet pressure, with stainless steel strainer screen, with gauge tappings, manufactured by Watts No. U5B, or approved equal.

2.7 WATER METERS
A. Main Building Water Meter: Specified and detailed by Civil.
B. Water Meter: Bronze “Omni” type water meter, with range of .50 to 200 gpm, ANSI/AWWA Standard C701 compliant, floating ball impeller, thermoplastic rotor with graphite bearing, registration accuracy of 100% at 1.5% of actual throughput, complete with integral inlet strainer, register with pulse output, 1 pulse per 10 gallons, manufactured by Sensus Omni C2, or approved equal. Provide the specified water meter for domestic cold water supply and for the domestic hot water supply serving the Café Area. Refer to plumbing floor plans for size.

2.8 TRAP PRIMERS
A. Electronic Type Trap Primer Assembly (Serving Floor Drains in Mechanical type Rooms and where indicated on drawings): Surface mounted, with resettable timer, factory assembled, pre-piped, bronze body, ¾" NPT, ¾" solenoid valve, Type “L” copper manifold with brass ½” compression fittings with single point 115 volt single phase power connection with manual override switch, 16 gauge steel enclosure with integral atmospheric vacuum breaker, with mounting anchors, manufactured by PPP Inc., Prime-Rite, or approved equal.
B. Where electric type trap primers are not indicated, provide ASSE 1072 compliant Rectorseal Floor Drain Trap Sealer (Sure Seal) in all floor drains and floor sinks, except shower drains do not need trap seal protection.
C. Trap Primers Serving Floor Drains/Floor Sinks supplied from sink or lavatory: Under Lav/Sink type chrome plated body and cap, stainless steel screen, nitrile o-rings, chrome plated angle stop, operating range of 20-80 psig, manufactured by PPP Inc., “Prime-Pro” model No. Pro1-ULP500, or approved equal.

2.9 THERMOSTATIC MIXING VALVES
A. Provide rough bronze construction with a flow range of 1/2 gpm (minimum) through 4.5 gpm at 5 psi pressure loss with integral true service spring loaded check stops (rubber type duck bill check valves are not allowed) and dual stainless steel strainers on inlets, temperature adjustment range 60°F to 140°F, ASSE 1017/1070 compliant, outlet temperature set at 110°F at Sinks and Lavatories with manual faucets and 105°F at Lavatories with sensor faucets, rough chrome or brass finish on valve body. Provide mixing valve in recessed stainless steel cabinet with lockable door. Check stops shall allow water to be shutoff to mixing valve for cartridge maintenance, Manufactured by Symmons 7-225-B-CK-MS-X-T, or approved equal by Powers or Bradley.
B. Lab Sink Eyewash TMV: Provide rough bronze construction, 1.5 gpm minimum, 3 gpm at 5 psi drop, check stops in inlet, adjustable set point, built-in cold water bypass, positive hot water shutoff upon cold water pressure loss, dial thermometer, ANSI Z358.1, ASSE 1071 certified,
wall mounting bracket. Set discharge temperature at 85 deg F. Manufactured by Bradley S19-2000-B or approved equal.

2.10 EXPANSION TANK

A. ET-1: ASME coded pre-charged hydropneumatic steel expansion tank, constructed with a maximum working pressure of 150 psig. Internal wetted parts in compliance with FDA regulations and approvals. Internal butyl diaphragm, isolating air from water. Refer to plumbing drawings/schedules for volume and dimensions. Manufactured by Amtrol Therm-X-Trol or approved equal by Watts or Taco.

2.11 LAB WALL WATER OUTLETS

A. Provide mechanical faucet with serrate nozzle, full flow nozzle, single hole, vandal proof indexed cross handle, 3/8” – 18 NPT male threaded inlet, chrome plated, rated for 20-125 psi, manufactured by Chicago Faucet Model No. 937-CP, or approved equal.

2.12 GROUT


B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.13 WATER SOFTENER

A. Provide twin alternating unit consisting of a steel tank with epoxy coated interior and primed exterior with polyurethane finish softening tank with one piece polyethylene brine tank. Softening tanks shall be NSF, FDA and UL approved. Unit shall be manufacturer’s built in accordance with ASME code construction, rated for a 150 psi working pressure. Unit shall be complete with side mounted integral diaphragm valve nest for each tank, automatic self-adjusting brine injector, flow controller, factory wired, water meter initiated regeneration, water hardness test kit, and manual regeneration function. Refer to plumbing drawings for capacity. Provide test port downstream of both softening tanks with a front display on controller, 120 volt, single phase power requirement. Unit shall be designed where the maximum unit height shall be 84”, including Contractor installed supply and discharge piping. Manufactured by Unity, Watertech or Mueller.

2.14 PRESSURE REDUCING VALVES

A. Pressure Reducing Station: Provide Cla-Val No. 90G-01AS, or approved equal, pressure reducing valve, ASTM A536 ductile iron body, stainless steel stem, spring & nut, Buna-N rubber disc, rated for 400 psi, bronze trim, globe style, threaded or flanged ends, automatically reduces higher inlet pressure with steady downstream outlet pressure, adjustment range 30-300 psi with
flow clean style strainer and flow control, minimum flow rate of 15 - 20 gpm. Provide additionally a Cla-Val No. CRD-L, or approved equal, pressure reducing valve, ASTM B62 bronze body and cover, reinforced neoprene diaphragm, ASSE approved, 416 stainless steel trim and strainer, adjustment range of 28 psi to 85 psi. Provide Cla-Val No. 50G-01, or approved equal, pressure relief valve, hydraulically operated pilot controlled, modulating valve, angle style, threaded ends, ASTM A-536 ductile iron body, stainless steel stem, spring and nut, nylon reinforced Buna-N rubber diaphragm, Buna-N rubber disc, rated for 400 psi.

B. Point of use Pressure reducing valves (For sizes 2” and smaller): Lead free automatic in operation, adjustable, renewable stainless steel seat, bronze body, adjustable from 25-75 psi outlet pressure, with stainless steel strainer screen, with gauge tappings, manufactured by Watts No. LFU5B-Z3, or approved equal.

2.15 EMERGENCY WATER SHUT-OFF (LEAK DETECTION) SYSTEM

A. General: Designed to shut-off water to building if Basement begins to flood, due to domestic water leak or full flow discharge of main reduced pressure backflow preventers in Basement. Consisting of electric motor operated valve (block valve), control panel, conductivity sensor and associated hardwire and wiring for a complete operational system.

B. Motor operated valve (Block valve): Fully lugged resilient seated butterfly valve, ASTM A126 Class B body construction, Nylon 12 coated ductile iron ASTM A536 Grade 65-45-12 disc, ASTM A479 Type 410 stainless steel stem, EPDM Food Grade seal, designed for deadend service without downstream flange installed, manufactured by DelTech “DelVal” Series 50/52, or approved equal. Complete with quarter turn electric actuator, consisting of Nema 4X enclosure, 110 volt single phase 60 hertz power requirement, squirrel caged induction motor, built-in thermal protection, position indicator, manual override, self-locking double worm gear, (2) ¾” conduit entries, EP type grease lubrication, polyester powder coated external coating, manufactured by DelTech “DelTorq” Series 2E, or approved equal.

C. Control Panel: Nema 4X, wall mounted, 120 volt single phase, 60 hertz power requirement, designed to interface with motor operated valve, flow sensor probes, with delay timer, resettable local audible and visual alarms, dry contact for alarm condition (water detection), manufactured by Cougar Sales “Water Detection MOV” control panel.

D. Leak Detection Sensor: Corrosion resistant PVC fitting, 2” NPT fitting, polycarbonate housing, CSA approved, pressure tight assembly, PVC base material, 2 probes, 316 stainless steel inserts for use with ¾” rod extensions, manufactured by Gems Sensors Series 3G, or approved equal.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section, Earth Moving, for excavating, trenching, and backfilling.
3.2 CONNECTION

A. Install unions downstream of all threaded valves and in all locations that supply serviceable equipment.

B. Screwed Joints: Make joint with clean, full cut standard pipe threads. Ream after cutting and threading. Use heavy duty Teflon sealing compound or Teflon tape as threaded seal. Sealing compound shall be AGA and NSF certified, non-toxic, non-drying, anti-seize, and classified by UL.

C. Use anti-seize compound on all bolts for flanges.

D. Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s).

3.3 INSTALLATION

A. For buried water service, clamp water pipe at fittings with 3/4 inch rods and properly anchor and support.

B. Provide in-line strainer upstream of trap primers. Supply line to trap primers shall be taken off top of domestic cold water main, per manufacturer’s recommendations.

C. Provide a pressure gauge on each side of balancing valves on domestic hot water return loops.

D. Provide backflow preventer certification documentation prior to final acceptance of system.

E. No pulled tees (T-drill) are allowed.

F. Directly downstream from the water heater a thermowell shall be provided for a temperature sensor which will be provided by Division 23 DDC. The temperature sensor shall send an alarm signal to the DDC when the system temperature decreases lower than 130 degrees F.

G. Directly downstream from the hot water return circulation pump a thermowell shall be provided for a temperature sensor which will be provided by Division 23 DDC. The temperature sensor shall control the on/off function of the pump. The pump shall cut on when the temperature decreases to 130 degrees F. The pump shall cut off when the system temperature reaches 140 degrees F. There shall be a override (timer) by the DDC system which will cut off the pump during nighttime hours from 10pm to 4am, unless there is a demand on the system.

H. On the domestic cold water supply to the building a thermowell shall be provided to receive a pressure sensor by Division 23 DDC. The pressure sensor shall alarm when the building pressure drops below a pressure setting. Refer to plumbing drawings for location of the sensor.
3.4 DRAINAGE

A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 feet, minimum, to low points to provide complete drainage of the system. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements in Section 22 0553, Identification for Plumbing Piping and Equipment, for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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.

C. 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. Repair 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.
D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 CLEANING

A. Clean and disinfect 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.
      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. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION
SECTION 22 1119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for furnishing and installation of plumbing specialties including the following:
   1. Pressure and temperature taps.
   2. Automatic air vents.
   3. Pressure gauges.
   4. Thermometers.

B. Section 22 1116, Domestic Water Piping Systems.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. NSF Compliance:
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pressure and Temperature Tap: Subject to compliance with requirements, provide products by Peterson Engineering Company, or Sisco.

B. Automatic Air Vents: Subject to compliance with requirements provide cast iron body with stainless steel seat and float as manufactured by one of the following:
   1. Apco.
   2. Armstrong.
   3. Clark.
4. ITT Bell & Gosset.
5. Taco.

2.2 PRESSURE AND TEMPERATURE TAPS
A. Location: Provide pressure and temperature taps where indicated on plumbing drawings and details.
B. Taps: Provide ½ inch solid brass fittings which will receive either a pressure or temperature probe with valve core of Nordel and fitted with a color coded cap and gasket. Furnish "Pete’s Plug" as manufactured by Peterson Engineering Company, or “Sisco P/T Plug” as manufactured by Sisco, No. 710, rated at 275°F and 1000 psig. Provide long stem type for insulated pipe.
C. Instruments: Provide two No. 500 "Pete’s Plug” pressure gauge adapters with four gauges and probes, and four 5 inch stem pocket thermometers. Two thermometers for domestic hot water systems when applicable. "Pete’s plugs” to match insulation thickness.

2.3 WATER SYSTEM AIR VENTS
A. Furnish and install cast iron body fixed pivot ball automatic float-type air vents at high points of all hydronic systems and where shown on Drawings.
   1. Cast iron vent body with stainless steel float, and stainless steel seat, valve and lever.
   2. Rate vent for a minimum 125 psi, 400°F.
B. Extend 1/2-inch copper discharge drain to nearest floor or hub drain.
C. Ball Valve: Place between air vent and piping system.
   1. 600 pound w.o.g., full port two-piece ball valve with stainless steel ball, reinforced seat, blowout proof stainless steel stem and lever handle, similar to Nibco T-585-70-66LF.

2.4 GAUGES AND THERMOMETERS:
A. General. Provide gauges and thermometers for monitoring plumbing systems as shown on the drawings and specified herein.
B. Gauges. Gauges shall be Ashcroft, Trerice, Weksler, Moeller, or U.S. with 4-1/2" dial face, phenol case, stainless steel movement with Grade A phosphor bronze bourdon tube and micrometer-type calibration adjustment screw. Accuracy shall be 1/2 of 1% of full scale. Provide a Crane No. 222H or needle valve with snubbers at the pumps. Provide liquid filled gauges at pumps. Gradation shall be one pound or less.
C. Thermometers. Thermometers shall be Weksler, Marshall Town or Ashcroft with 5" dial, all stainless steel construction bi-metal type with accuracy of +/- 1% of scale range. Minimum of 2-1/2" straight or angle form stem as best suited for reading. Stem length shall be sized to provide most accurate reading for pipe diameter.
D. Thermometer Wells. Thermometer wells shall be brass or stainless steel with pressure and temperature ratings suitable for their application. Wells for insulated piping shall have a 2-1/2" lagging protrusion. Locate thermometer wells so the sensing bulb will give a true and correct
reading. Install thermometer so as not to cause undue restriction in small piping. Where wells are located in pipelines 1-1/2" and smaller, provide a section of pipe of such diameter that the net area of the pipeline will not be reduced by the thermometer well. All wells shall be filled with silicon and complete with caps and chains.

E. Range and Gradations. Gauges and thermometers shall be selected to give range and gradations best suited for quantities to be measured. Generally, gauges and thermometers shall be selected so that normal operating pressures and temperatures are not more than 2/3 nor less than 1/2 of the range; scale division shall be 1°F. Typical ranges for domestic cold water and shall be 0° to 100°F and for domestic hot water shall be 30°F to 240°F.

F. Gauge Locations. Provide pressure gauges at the following locations:
1. Suction side of each pump (except sump pumps and sewage ejectors).
2. Discharge side of each pump (except sump pumps and sewage ejectors).
3. At the main domestic service entry.
4. At the top of the main domestic water risers.

G. Thermometer Locations. Provide thermometers and thermometer wells at the following locations:
1. On each hot water circulating loop return line from the building (locate near circulating pump).
2. On each incoming cold water supply to each domestic water heater.
3. On the outlet hot water from the domestic water heater.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 22 0500, Common Work Results for Plumbing, for piping joining materials, joint construction, and basic installation requirements.

B. Install hydronic specialty items as shown on Drawings and in accordance with manufacturer’s installation requirements.

C. Provide automatic air vents at all high points in systems. For air vents above ceilings and concealed areas, provide copper vent tubing to nearest hub or floor drain.

D. For strainers, provide valve connection piped to floor drain at all pumps. On strainers that are not piped to drain, provide valved connection with hose adapter and cap.

E. Provide valved manual air vent where indicated on Drawings. Install pipe plug in valve.
SECTION 22 1316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes requirements for furnishing and installing sanitary waste, soil and grease waste system piping and associated vent piping within buildings and underground laterals within 5 feet of building.

1.2 RELATED WORK
A. Section 22 0500, Common Work Results for Plumbing.
B. Section 22 0553, Identification for Plumbing Piping and Equipment.
C. Section 22 0529, Hangers and Supports for Plumbing and Equipment.
D. Section 22 1423.13, Roof Drainage Piping Systems

1.3 PERFORMANCE REQUIREMENTS
A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1.4 SUBMITTALS
A. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE
A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. General: All aboveground including crawl space sanitary sewer shall be service weight cast iron marked with collective trademark of CISPI. Manufactured by Charlotte, Tyler or AB & I.

B. Underground Piping: ASTM A 74 hot-dip coated, service weight cast iron bell and spigot soil pipe, DWV pattern fittings with ASTM C 465 neoprene gaskets.

C. Above Grade Piping:
   1. Service weight cast iron no-hub soil pipe and DWV pattern fittings.
   2. Heavy duty shielded stainless steel couplings and tightening devices, ASTM C564 rubber sleeve.
   3. 4-band no-hub couplings for pipe sizes 4 inches and less. 6-band no-hub couplings for pipe sizes over 4 inches.
   4. Couplings manufactured by Anaco "Husky" SD4000, Ideal Tridon HD or Clamp-All 125.

D. Piping through Wall Sleeves: Provide section of ductile iron piping, as detailed, in wall penetrations.

2.2 VENT PIPE AND FITTINGS

A. Vent pipe and fittings shall be same as specified for sanitary sewer herein.

B. Provide heavy duty type 304 stainless steel minimum 4-band no-hub couplings, conforming to C.I.S.P.I. 310 as specified for drainage piping.

C. Pipe shall conform to ASTM A 74, ASTM A 53 or ASTM B 306, where applicable.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Section 22 1316, Sanitary Waste and Vent Piping.

B. Basic piping installation requirements are specified in Section 22 0500, Common Work Results for Plumbing.

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 Section 22 0500, Common Work Results for Plumbing.

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Section 22 0500, Common Work Results for Plumbing.
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."

F. Make changes in direction for soil 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. Vent Connections: Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through roof to at least 6 inches above roof.

H. Flashing: Provide flashing as recommended by roofing material manufacturer and detailed by Architect/Engineer.

I. Cleanouts:
   1. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed. No cleanout should be larger than 4 inches in diameter.
   2. Where cleanouts occur in pipe chases, bring cleanouts through walls and install covers. Where cleanouts occur in floor slabs, set flush.
   3. Provide cleanouts where soil lines change every direction, every 50 feet on long runs, at end of each continuous waste line, and at the base of each riser.

J. Floor Drains: Locate floor drains 1/2 inch below finish floor elevation unless shown otherwise.

K. Slope sanitary waste piping at a uniform slope of 1/8" per foot for pipes sizes 3-inch and larger and 1/4" per foot for pipe sizes less than 3-inch. Slope vent piping at a uniform 1/8" per foot slope with the high point at the roof penetration, sloping back down toward the plumbing fixture. Refer to the plumbing code.

L. Provide joint restraints on cast iron piping for pipe sizes over 4” and in changes in pipe diameter by two pipe sizes or more, and indicated in IPC Section 308, and conforming to CISPI 301-09. Joint restraints shall be Holdrite #117, or approved equal, or as shown on the Plumbing drawings.

3.2 UNDERGROUND PIPING INSTALLATION

A. Pipe Grading: Lay and maintain all pipes at required lines and grades during the course of work to comply with Drawings.

B. Trench:
   1. Excavate trench to depth required.
   2. Properly brace and dewater trench and keep it free of water during installation, testing of pipe, and backfilling.
   3. Do not discharge water onto a street or freeway without prior approval from Owner’s Representative.

C. Excavation:
1. Trench shall be at least 18 inches wider than the maximum diameter of the pipe or largest bell and laid in the center of the trench.
2. Excavate trench to a minimum depth of 12" below the bottom of the final elevation of the pipe.
3. Increase trench width as required and piling left in place until sufficient compacted backfill is in place.
4. Properly sheet and brace all open trenches to render them secure and remove all such sheeting and bracing before completing the backfill.
5. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.
6. The quantity of excavation required to install sheeting and the installation and removal of sheetings and bracings will not be regarded as Extra Work. All costs incurred for this excavation and the installation of sheeting shall be included in the Contract Price.
7. Refer to Structural and Civil drawings for trench details.

D. Grading:
1. Upon Completion of excavation and prior to the laying of the pipe, the trench bottom shall be brought up to the required elevation with a pipe cushion as per Division 31, except where the cushion has been eliminated by the Engineer.
2. Pipe cushions shall be select material deposited in the trench and shall be compacted, leveled off, and shaped to obtain a smooth compacted bed along the laying length of the pipe. Pipe cushion shall be as follows:
   a. Stable, Firm Semidry Trench: Piping shall be laid on bedding of washed sand with minimum 3 inches thick all around pipe and covering pipe.
   b. Undisturbed earth, in a constant uniformly sloped trench shall be under the sand bed.
   c. Laying space for hubs or mechanical joints shall be hand cut to 6 inches either side of the joint and stabilized sand poured and wet in to even with the natural earth trench bottom.
   d. The leakproof integrity test of the piping system shall be inspected by the Owner's Representative prior to covering the piping.
   e. Failure to notify the Owner's Representative for inspection prior to covering the piping will result in the piping being uncovered and the test being performed again.
   f. Where the slope of the trench is found to belly down along the line of piping, before joining, the pipe shall be removed from the trench and the belly converted to uniform slope by adding stabilized bank sand, wet down and slightly mounded to the center of the trench. The section of piping will then be "rolled" into place so with support uniform along its entire length.
   g. Where the slope of the trench is found to arch up along the line of piping, before joining, the pipe shall be removed from the trench and the arch converted to uniform slope by cutting the arch out. The section of piping will then be reset into place with support uniform along its entire length.
3. Wet Clay (Black Gumbo): Lay piping in a constant, uniformly sloped trench. After shaping, the trench shall receive 6 inch minimum clean bedding sand, which shall be uniformly distributed on the trench bottom.
   a. Hand remove laying space for the hubs or mechanical joints and place the piping on the setting bed with the weight of the piping distributed evenly on the setting bed over its entire length.
   b. The leakproof integrity test of the piping system shall be inspected by the Owner's Representative prior to covering the piping by the Engineer's agent. Failure to notify the Owner's Representative for inspection prior to covering the piping will result in the piping being uncovered and the test performed again.
4. Rock: Where rock is encountered, the excavate trench to a minimum of 6 inches below the pipe elevation and backfill with bedding sand to provide a uniform layer for pipe support. Backfill shall be as indicated for Wet Clay- Black Gumbo.

E. Special Considerations: Where there are expansive soil conditions on the site, special precautions shall be taken to prevent pushing and breakage of underground piping. Precautions shall be in accordance with local installation techniques and may include carton forms or special pipe bedding.

F. Backfill: Backfill trenches only after piping has been inspected, tested, and approved by the Owner Representative.
1. Place backfill material in the trench either by hand or approved mechanical methods. The compaction of backfill material shall be accompanied by tamping with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling, or by any combination of the three.
2. The method of compaction shall be approved and all compaction shall be done to the satisfaction of the Architect.
3. Backfill completely around pipe, including 18 inches above the pipe, with suitable bank sand, tamped in 4 inch layers under, around, and over pipe. Water down backfill as required.
4. The remainder of the backfill for pipes shall be select backfill material tamped at intervals of no more than 12 inch depths, to attain a 95 percent Proctor Compaction Density:
   a. All materials to be used as select material backfill shall be approved by the Architect.
   b. If, in the opinion of the Architect, the excavated material does not meet the requirements of select material, the Contractor shall be required to screen the material prior to use as select material backfill.
   c. Material used in the upper portion of the backfill or subgrade shall not contain stone, rock, or other material larger than 6 inches in longest dimension. No wood, vegetable matter, or other material, which in the opinion of the Architect is unsuitable, shall be included in the backfill.
   d. The upper 24 inches of backfill may be water jetted, if desired. Bring backfill up to finish grade identified on the Architectural Drawings, including additional backfill required to offset settlement during consolidation. When removal of unsuitable, excavated material creates a shortage of backfill material, the Contractor shall, at no change in Contract amount, furnish material as specified in this Section in the amount required to complete the backfill.

G. Existing Surfaces: Restore existing streets, driveways and sidewalks damaged during the excavation work to acceptable condition, subject to approval by the Architect.

H. Safety: Provide street and sidewalk excavations with approved barricades, warning lights, and cover plates as required by the City. Refer Division 1 for additional requirements.

I. Underground Piping under Slabs with Carton Forms
1. Upon completion of excavation the carton forms shall be provided in trench for pipe to rest on with a minimum clearance of 12" from bottom of pipe to bottom of trench.
2. Clevis hangers shall be installed to support pipe w/continuous threaded rods from concrete slab as detailed on Plumbing drawings and Structural drawings.
3. Clevis hanger support shall be installed at end pipe joint and change of direction
3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Section 22 0500, Common Work Results for Plumbing.

   1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
   2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. 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.

D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

A. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
   1. Use gate or full-port ball valve for piping NPS 2 and smaller.
   2. Use gate valve for piping NPS 2-1/2 and larger.

B. Check Valves: Install swing check valve, downstream from shutoff valve, on each submersible pump discharge.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Section 22 0548, Vibration Isolation for Plumbing Piping and Equipment.

B. Pipe hangers and supports are specified in Section 22 0529, Hangers and Supports for Plumbing Piping and Equipment. Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. 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.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Section 22 0529, Hangers and Supports for Plumbing Piping and Equipment.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. 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. Spacing for 10 foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 84 inches with 3/8 inch rod.
   2. NPS 1-1/2: 108 inches with 3/8 inch rod.
   3. NPS 2: 10 feet with 3/8 inch rod.
   4. NPS 2-1/2: 11 feet with 1/2 inch rod.
   5. NPS 3: 12 feet with 1/2 inch rod.
   6. NPS 4 and NPS 5: 12 feet with 5/8 inch rod.
   7. NPS 6: 12 feet with 3/4 inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. 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.

K. Install supports for vertical copper tubing every 10 feet.

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer’s written instructions.

3.6 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

3.7 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. Test pipe before backfilling and connecting to sewers by maintaining not less than 10 feet of hydrostatic head for 4 hours without a leak.
   2. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   3. 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 drainage and vent piping according to procedures of authorities having jurisdiction.
   1. After all sections of soil, waste, and vent piping are installed, but before fixtures are connected, test system by plugging all outlets and filling vertical sections with water to maintain not less than 10 feet of hydrostatic head for 4 hours without any drop in water level for all sections of piping. Provide wyes as required to facilitate plugging.
   2. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   3. Prepare reports for tests and required corrective action.

3.8 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.

END OF SECTION
SECTION 22 1319
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.

1.2 RELATED WORK
A. Section 22 0500, Common Work Results for Plumbing.
B. Section 22 1423.13, Roof Drainage Piping Systems.
C. Section 22 1316, Sanitary Waste and Vent Piping.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated. Include rated capacities, operating
   characteristics, and accessories.

1.4 QUALITY ASSURANCE
A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing
   agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one
   of the following, except special custom trench drains which shall be only the specified
   manufacturer:
   1. Wade
   3. Josam
   4. Zurn Plumbing Products Group; Specification Drainage Operation.
2.2 CLEANOUTS

A. Location:
1. Provide drainage lines with properly specified cleanouts.
2. Locate cleanouts in runs not more than 90 feet on centers or as required by local authority having jurisdiction.
3. Provide cleanouts at the base of each soil or waste stack and wherever necessary to make accessible all parts of the drainage soil or waste systems, whether or not indicated on drawings.
4. Extend cleanouts within chases to near wall and provide wall access cover compatible with wall construction.
5. Provide cleanouts of required size, with flashing flange where installed with membrane waterproofing.

B. Finished and Unfinished Walls. Jay R. Smith 4430, duracoated, cast iron cleanout with cast bronze plug and chrome-plated bronze square frame and secured cover with vandal-proof screws.

C. Exposed Piping. Jay R. Smith 4505, duracoated, cast iron calk ferrule and cast bronze plug with ½" NPT test port with raised head plug and internal threading for test plug use.

D. Outside Area. Jay R. Smith 4220, duracoated, cast iron cleanout with taper thread bronze plug, adjustable housing, and heavy-duty tractor-type cover with vandal-proof screws, cast flush in a 16 inch x 16 inch x 6 inch thick concrete pad in nonsurfaced areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 22 0500, Common Work Results for Plumbing, for piping joining materials, joint construction, and basic installation requirements.

B. 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.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. 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.

E. Install deep-seal traps on floor drains and other waste outlets, if indicated.

F. 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.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

3.2 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.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 0553, Identification for Plumbing Piping and Equipment.

3.4 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 22 4000

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Fixture Carriers.
   2. Lab Sink Faucets
   3. Emergency Shower Units
   4. Emergency Eyewash Units

B. Related Sections include the following:
   1. Section 22 1116, Domestic Water Piping.
   2. Section 22 0500, Common Work Results for Plumbing.

1.2 DEFINITIONS
B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
C. FRP: Fiberglass-reinforced plastic.
D. PMMA: Polymethyl methacrylate (acrylic) plastic.
E. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: Diagram power, signal, and control wiring.
C. Operation and maintenance data.
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.


C. Regulatory Requirements:
2. Comply with requirements in Texas Senate Bill 587 for requirements about minimum water conservation performance requirements.

D. NSF Standard: Comply with NSF 61, “Drinking Water System Components—Health Effects,” for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
5. Vitreous-China Fixtures: ASME A112.19.2M.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
5. Hose-Connection Vacuum Breakers: ASSE 1011.

H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
2. Brass and Copper Supplies: ASME A112.18.1.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Disposers: ASSE 1008 and UL 430.
   6. Off-Floor Fixture Supports: ASME A112.6.1M.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers.

B. Lavatory & Sink Faucets:
   1. Chicago Faucets
   2. Kohler.
   5. T&S Brass.
   7. Watersaver

C. Sink Trim (Supplies, Traps, Strainers):
   1. McGuire
   2. Elkay Manufacturing Co.
   3. Chicago Faucets.
   5. Kohler Co.

D. Emergency Showers:
   1. Haws.
   2. Guardian.
   4. Acorn Safety
   5. Watersaver

E. Plumbing Fixture Carriers
   1. Wade
   2. Zurn
   3. Jay R. Smith
   4. Josam
2.2 LAB SINKS

A. Lab Sinks are Specified by Architect with Lab Casework (LS-1)
   2. Faucet: Chicago Model No. 930-317CP, deck mounted brass hot and cold water fitting with rigid/swing gooseneck vacuum breaker spout, ADA compliant, wrist blade handles, quarter turn cartridges, serrated nozzle spout outlet,
   3. Supplies: McGuire No. LF2165-LK supply, escutcheon, 3/8" x 12" flexible tube riser and loose key control angle stop, all with chrome finish. Compression connections are not allowed.
   4. Trap: Refer to specification section 22 6653 paragraph 2.2a.
   5. Drain: 1-1/2" polypropylene sink drain outlet with integral strainer and removable plug. Manufactured by Ipex (Labline) No. W301 or approved equal. Coordinate with integral sink drain outlet.
   7. Thermostatic Mixing Valve, see Section 22 1116, pa 2.9A.

B. Lab Sinks are Specified by Architect with Lab Casework (LS-2)
   1. Same as LS-1, except with Emergency Eyewash Unit (Where indicated on Architectural Drawings): Eyewash specified by others.
   2. Eyewash Thermostatic Mixing Valve, see Section 22 1116, pa 2.9B.

2.3 FIXTURE CARRIERS

A. Water Closet Carriers: Wade 310, 330 & 340 Series or approved equal.
   1. Adjustable heavy duty (for extra heavy weight support - minimum 500 lbs. capacity by independent testing lab) cast iron horizontal or vertical integral carrier fitting with neoprene faceplate gasket and anchoring feet, complete with rear anchor support.

B. Urinal Carriers: Wade 400 Series or approved equal.
   1. Free standing concealed chair carrier with rectangular steel uprights, support studs, bearing plate and anchoring feet plate.

C. Lavatory Carriers: Wade 520 or approved equal.
   1. Free-standing adjustable for concealed arms, steel uprights, bearing plate and anchoring feet plate, ductile iron arms, invertible headers.

2.4 WATER HAMMER ARRESTORS

A. Provide hydraulic shock absorbers in cold and hot water supply lines to each individual plumbing fixture or battery of fixtures, and at each automatic, solenoid-operated or quick-closing valve serving mechanical, kitchen or laundry equipment. Shock arrestors shall be of seamless type "K" copper body construction or type 304 stainless steel body with stainless steel bellows, nitrogen and helium gas pre-charged. Shock arrestor shall be certified to ASSE 1010-2004 Standard and listed with IAPMO, completely sealed and operating free of casing. Size all units according to water hammer arresters standard PDI-WH-201. The shock arrestor shall have a lifetime warranty and shall be designed to provide continuous protection without maintenance allowing the shock arrestor to be installed without an access panel. Manufactured by Sioux Chief "Hydra-Rester", Mi-Fab, Jay R. Smith and FNW.
2.5 COMBINATION EMERGENCY SHOWER AND EYEWASH UNIT


PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers’ written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install wall-mounting fixtures with tubular waste piping attached to supports.

E. Install fixtures level and plumb according to roughing-in drawings.

F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

H. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

I. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

J. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

K. Install traps on fixture outlets:
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

L. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Section 22 0500, Common Work Results for Plumbing.

M. Refer to Architectural drawings for fixture mounting heights.
N. Provide an ASSE 1070 compliant thermostatic mixing valve on the domestic hot water and cold water supply piping serving break room sinks, hand wash sinks and lavatories, and where shown on the drawings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 requirements.

D. The installation of rough-ins and carriers of water closets shall be inspected by Owner and/or Engineer prior to coverup. The supports/carriers for water closets shall be securely anchored to the floor and shall be heavy weight type carriers, rated to support a minimum of 500 lbs.

E. For sinks indicated to be provided by Division 22, provide the same supply stops as specified for sinks herein. Compression connections are not allowed.

F. Install shock arrestors on pipe headers for fixture groups in locations shown on plumbing riser diagrams and as recommended by the manufacturer. Domestic water supplies to single plumbing fixtures shall be provided with shock arrestors. The use of only air chambers as shock protection is not allowed.

3.3 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION
SECTION 22 6119

COMPRESSED AIR SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

1. Provide compressed air piping connected to existing infrastructure. For the systems rough-in and make final connection of piping system to counter mounted valve outlets, fume hoods, overhead service carriers, service fittings, etc. where indicated on the Plumbing floor plans. Provide and install all piping, fittings, valves, etc. for a complete operational laboratory air systems. This Section includes requirements for compressed air systems and the following accessories:

2. Valves.
3. Pipe and fittings.

1.2 RELATED SECTIONS

1. Section 22 0500, Common Work Results for Plumbing.
2. Section 22 0526, Pipe and Fittings.
3. Section 22 0553, Identification for Plumbing Piping and Equipment.
4. Section 22 6219, Laboratory Vacuum System.

1.3 SUBMITTALS

1. Product Data: For each type of product indicated.
2. Delegated-Design Submittal: For compressed-air equipment mounting indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation:
3. Detail fabrication and assembly of supports.
4. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
5. Field quality-control reports.
6. Operation and maintenance data.

1.4 QUALITY ASSURANCE

1. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the compressed-air equipment testing indicated, that is an NRTL and that is acceptable to authorities having jurisdiction.
2. Qualify testing personnel according to ASSE 6020 for inspectors and ASSE 6030 for verifiers.
3. 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.
4. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.
5. Comply with NFPA 99, "Health Care Facilities," for compressed-air equipment and accessories where designated for laboratory air systems and medical compressed air systems.
1.5 DELIVERY STORAGE AND HANDLING
1. Deliver pumping systems, controllers, and accessories in factory-fabricated water-resistant wrapping.
2. Handle pumping systems, controllers, and accessories carefully to avoid damage to materials, components, enclosure, and finish.
3. Store pumping systems, controllers, and accessories in a clean, dry space and protect from the weather.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS
1. Hard drawn Type “L” copper pipe, conforming to ASTM B819, factory prepared for oxygen service, as specified herein. Fittings shall be seamless wrought copper, socket joint, ANSI B16.22. Joints shall be brazed, using nitrogen purge, as specified herein. Brazing alloy shall be NFPA 99C compliant, conforming to BS EN 10044CP. Unions shall be wrought copper with metal to metal seats.

2.2 GAUGES
1. Bourbon tube type, with stainless steel spring, suspended movement, 316 stainless steel bourbon tube, with minimum 2-1/2 inch dial, shatterproof glass window with stainless steel case, 1/4 inch NPT brass socket connection, 1 percent full scale accuracy and shall be made in accordance with ASME 40.1 grade 1A, scale range 0-160 psi, Figure intervals at 20 psi, and minor divisions at 2 psi increments, manufactured by Trerice No. 700 series, or approved equal.

2.3 UNIONS
1. Provide Class 150, 300-pound water-oil-gas service wrought solder joint fitting, such as Nibco 633/733 union C x C, or approved equal, ANSI B16.22. Flange joints larger than 2 inches shall be brass. Provide dielectric isolating unions or connections between metallic piping of dissimilar metal.

2.4 VALVES
1. 3-piece bronze ball valve with extended copper tube ends, 316 stainless ball and stem, 600 WOG, full port, in-line repairable, RPTFE seats, blow out proof stem, manufactured by Milwaukee No. BA350S-TE or approved equal.

2.5 PIPE SUPPORTS
1. Refer to Section 22 0529, Hangers and Supports for Plumbing Piping and Equipment.
or that are furnished unsuitable for laboratory air applications, according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."

2. Ream pipe and tube ends full pipe bore. Remove burrs. Bevel plain end ferrous pipe. Remove scale dirt on inside and outside before assembly. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION
1. Route piping in orderly manner and maintain gradient.
2. Install piping to conserve building space and not interfere with use of space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
5. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.
6. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
7. Contractor is responsible for complying with all state and local regulations

3.3 CONNECTIONS
1. Comply with requirements for water-supply piping specified in Section 22 1116, Domestic Water Piping Systems. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Comply with requirements for drain piping specified in Section 22 1316, Sanitary Waste and Vent Piping. Drawings indicate general arrangement of piping, fittings, and specialties.
3. Install piping adjacent to equipment to allow service and maintenance.
4. Connect compressed air piping to compressed air equipment, accessories, and specialties with shutoff valve and union or flanged connection.

3.4 IDENTIFICATION
1. Identify compressed-air equipment system components. Comply with requirements for identification specified in Section 22 0553, Identification for Plumbing Piping and Equipment and NFPA 99. The compressed air system shall have piping, fittings and valves identified as lab air use, and lab equipment use.

3.5 FIELD QUALITY CONTROL FOR COMPRESSED AIR SYSTEMS
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
3. Perform tests and inspections:
4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
5. Tests and Inspections:
6. Compressed Air Equipment Testing Coordination: Perform tests, inspections, verifications, and certification of compressed-air equipment concurrently with tests, inspections, and certification of compressed air piping and laboratory gas piping systems.
7. Preparation: For the Lab Air System perform compressed air equipment tests according to requirements in NFPA 99 for the following:
   a. Air quality purity test.
   b. System operation test.

8. Compressed Lab Air System: Equipment Verification: Comply with requirements in ASSE 6020, ASSE 6030, and NFPA 99 for verification of compressed air equipment.

9. Replace damaged and malfunctioning controls and equipment.

10. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
    a. Inspections performed.
    b. Procedures, materials, and gases used.
    c. Test methods used.
    d. Results of tests.

11. Components will be considered defective if they do not pass tests and inspections.

12. Prepare test and inspection reports.

13. Follow NFPA 99 guidelines and requirements for the compressed lab air system.

3.6 ALL THE COMPRESSED LAB AIR SYSTEMS DOES NOT NEED TO BE THIRD PARTY CERTIFIED, BUT SHALL COMPLY WITH THE REQUIREMENTS AND GUIDELINES OF NFPA 99 AS IT SHOWN AND SPECIFIED.

3.7 INSTALLERS FOR THE COMPRESSED LAB AIR SYSTEM SHALL BE CERTIFIED IN MEDICAL GAS PIPING SYSTEMS INSTALLATIONS.

END OF SECTION
SECTION 22 6653
LABORATORY CHEMICAL WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY
A. This Section Includes:
   1. Acid waste traps.
   2. Acid waste and vent pipe and fittings.

1.2 RELATED WORK
A. Section 22 0500, Common Work Results for Plumbing.
B. Section 22 1316, Sanitary Waste and Vent Piping

1.3 SYSTEM DESCRIPTION
A. Provide all labor, materials, equipment, tools, and services to perform all operations required in connection with or properly incidental to the construction of complete acid waste and vent system as indicated on Drawings, and as required for a complete and functional system.

1.4 PERFORMANCE REQUIREMENTS
A. Piping Pressure Rating: 10 feet head of water.

1.5 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: For leak-detection system. Include plans, elevations, sections, details, and attachments to other work.
   1. Cut sheets of acid waste/vent pipe, fittings, and other required accessories clearly indicating all features, options, materials, and dimensions.
   2. Acid neutralization basin, manholes/rings, and neutralization media.
   3. Wiring Diagrams: For power, signal, and control wiring.
C. Field quality-control test reports.
D. Operation and Maintenance Data: For chemical-waste specialties and neutralization tanks and leak-detection systems to include in emergency, operation, and maintenance manuals.
1.6 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 70, "National Electrical Code."

1.7 DELIVERY STORAGE AND HANDLING

A. Deliver acid resistant waste/vent piping system components in factory-fabricated water-resistant wrapping.

B. Handle acid resistant waste/vent piping system components carefully to avoid damage to material components, enclosure, and finish.

C. Store acid resistant waste/vent piping system components in a clean, dry space and protect from the weather.

1.8 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. Neutralization-Tank Limestone: Equal to 200 percent of amount required for each tank sump initial charge. Furnish limestone in 50-lb bags.

PART 2 - PRODUCTS

2.1 ACID WASTE TRAPS

A. All trap material shall be chemically resistant 3" deep seal Universal traps with 1-1/2" female inlet, constructed of flame retardant polypropylene. Unit shall have mechanical joints and all adapters and couplings required for a complete installation between sink outlet and drainage system. Manufactured by Enfield Model W501 or approved equal. Contractor’s option – Borosilicate glass drum traps and all associated connectors.

B. Joints: The joining of the cup sink tailpieces and other sink outlets and strainers to the acid waste piping system shall be the responsibility of the Mechanical Contractor.

2.2 ACID WASTE AND VENT PIPE AND FITTINGS

A. Pipe and fittings shall be of the same manufacturer and guaranteed by the manufacturer against failure for a minimum of 25 years.

B. Polypropylene Pipe and Fittings: Flame retardant schedule 40 polypropylene pipe (PPFR), NSF listed type 1, conforming to ASTM D4101. Matching fittings shall be as a minimum same material and thickness as pipe, with DWV pattern, joints shall be mechanical joints conforming
to ASTM F1412 where connecting to fume hoods, lab sinks and equipment. In all other locations utilize heat fusion joints.

2.3 HANGERS AND SUPPORTS

A. Horizontal Piping: Support fill horizontal piping on (padded) clevis type hangers.

B. Vertical/Riser Piping: Support all vertical/riser piping using riser clamps padded with 1/4 inch thick solid neoprene or Buna-N rubber.

C. Wall Chase Piping: Support all wall chase piping using the wall/chase support system as specified in Section 22 0529, Hangers and Supports for Plumbing Piping and Equipment.

D. Sleeves: Size sleeves per manufacturer’s recommendations for glass piping. All sleeves for glass pipe and fittings shall be 2 inches O.D. larger than pipe.

2.4 JOINING MATERIALS

A. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

B. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

C. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

D. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.


2. Design Mix: 5000-psi, 28-day compressive strength.


PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping, fittings and accessories in strict accordance with the manufacturer’s written installation instructions and applicable codes. Fabricate odd lengths of glass pipe by scoring
and breaking the pipe at the field bead location and then field beading the pipe as recommended by the pipe manufacturer.

B. Pipe Slope: Slope waste and vent piping as specified in Section 22 1316, Sanitary Waste and Vent Piping.

C. Damaged Piping: Remove damaged piping, including scratched or cracked glass piping, and replace at the Contractor's expense.

D. Buried Piping: Excavation and backfill for buried piping shall be as specified in Section 22 0500, Common Work Results for Plumbing, and Section 22 1316, Sanitary Waste and Vent Piping, and per the piping system manufacturer's requirements. Bedding backfilling shall comply with ASTM D2321.

E. Waterstops: Pipe passing through building walls or slabs shall pass through a pipe sleeve a minimum of 2" larger than the pipe OD. The annular space between the pipe and sleeve shall be sealed using segmented annular seals as specified in Section 22 0500, Common Work Results for Plumbing.

F. Hangers and Supports: The entire piping system and related hangers and supports shall be installed such that the piping system is properly aligned and free of stress.

G. Vertical stacks shall be supported at each floor using riser clamps. The lowest riser support shall be located below the lowest coupling/hub on the stack and shall restrict sideways as well as downward motion.

H. Horizontal piping shall be supported using Clevis type hangers with maximum hanger spacing per the manufacturer's installation instructions.

I. Locate hangers at each offset, bend or fitting. Support 1 foot of each joint upstream and downstream of joint. Follow pipe manufacturer's recommendations and guidelines.

J. Install cleanouts in horizontal lines at a maximum of 50 foot intervals.

3.2 LABELING AND IDENTIFICATION

A. Comply with requirements in Section 22 0553, Identification for Plumbing Piping and Equipment, for labeling of equipment and piping.
   1. Use detectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.3 FIELD QUALITY CONTROL

A. Inspect interior of sewerage piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place and again at completion of Project.
   1. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between inspection points.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Hydrostatic Tests for Drainage Piping:
   1) Allowable leakage is a maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
   2) Close openings in system and fill with water.
   3) Purge air and refill with water.
   4) Disconnect water supply.
   5) Test and inspect joints for leaks.
e. Air Tests for Drainage Piping: Comply with UNI-B-6.
2. Leaks and loss in test pressure constitute defects that must be repaired.
3. Submit separate reports for each test.

B. Replace leaking sewerage piping using new materials, and repeat testing until leakage is within allowances specified.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

D. 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.

E. Chemical-waste piping will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.4 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Clean piping by flushing with potable water.
SECTION 22 6719.16
REVERSE OSMOSIS (RO) WATER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes reverse-osmosis-water equipment and piping system.

1.2 DESCRIPTION
A. Provide and install all equipment, piping system components, and any miscellaneous items for a complete working RO water system.

1.3 RELATED WORK
A. Section 22 0500, Common Work Results for Plumbing.
B. Section 22 0529, Hangers and Supports for Plumbing Piping and Equipment.
C. Section 22 0553, Identification for Plumbing Piping and Equipment.

1.4 SUBMITTALS
A. Product Data: For each type of pipe and fitting indicated.
B. Field quality-control test reports.
C. Shop drawing submittals include but are not limited to the following:
   1. Cut sheets on all equipment showing features, characteristics, and capacities.
   2. Manufacturer’s recommended installation instructions for system.
   3. Water analysis results.
   4. Floor plan layout showing equipment in floor space available.

1.5 QUALITY ASSURANCE
A. Piping materials shall bear label, stamp, or other markings of specified testing laboratory.

1.6 DELIVERY STORAGE AND HANDLING
A. Components and accessories in factory-fabricated water-resistant wrapping.
B. Handle equipment and accessories carefully to avoid damage to material components, enclosure, and finish.

C. Store equipment and accessories in a clean, dry space and protect from the weather.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the listed manufacturers.

B. Pipe, Fittings, Valves:

1. Orion.
2. George Fischer.
3. Enfield.
4. Simtech.
5. Plast-O-matic.
6. Asahi.

2.2 PIPE AND FITTINGS

A. Not in Return Air Plenums: Provide and install Group 1 Class 2, nucleated homopolymer polypropylene piping with a pressure rating of 150 psi at 70°F (SDR 11), meeting ASTM D4101-86, and DIN 8077, and ASTM D-2837 and shall be capped at each end from factory. Fittings shall be same material, thickness and pressure rating as pipe, with socket fused, joints, manufactured by George Fischer “Beta” or Simtech “Puretech AP”, or approved equal.

B. In Return Air Plenums: Provide natural virgin unpigmented PVDF pipe and fittings with socket heat fused joints shall be used, conforming to ASTM D-3222 rated for minimum 150 psi at 68°F., meeting 25/50 flame and smoke spread requirements of ASTM E84 and UL910.

2.3 VALVES

A. Ball Valves: Provide and install true union style ball valves, factory tested to 150 psi at 73°F, same material as pipe with socket ends, blow-out proof stem, Teflon seats, Viton seals, fully compatible with specified pipe, manufactured by George Fischer Model 546, or approved equal.

B. Check Valves: Provide and install true union style ball check valves, polypropylene construction with socket ends, Viton O-ring and seating ring, 150 psi pressure rating at 68°F, manufactured by George Fischer No. 561, or approved equal.

C. RO water piping system valves within return air plenums shall be of PVDF construction, as specified for the piping.
2.4 PIPE CLAMPS

A. Support horizontal piping with padded clevis type hangers or trapeze hanger where grouped with other piping.

B. Where installed on trapeze hangers, directly to walls or within walls, provide and install pipe clamps constructed of U.V. stabilized polypropylene or nylon, to allow free axial pipe movement during expansion and contraction of pipe system.

C. Support spacing shall be to the pipe manufacturer's recommendations for the design temperature of the system, capable of mounting to steel framing channels or wall, manufactured by Enfield Cobra or Ryan Herco Clic.

2.5 FLOW CONTROL

A. Provide and install flow control valve, factory set at 1/2 gpm with polypropylene body and EPDM seal, will maintain constant flow with pressure changes 15 psi to 120 psi, manufactured by Plast-O-matic, or approved equal. To be provided upstream of lab sink RO faucets only.

2.6 PIPING MATERIALS

A. Transition Fittings: Couplings, flanges, or other manufactured fittings, same size as, with pressure rating at least equal to and ends compatible with piping to be joined.

PART 3 - EXECUTION

3.1 SANITIZATION

A. Water treatment vendor shall be responsible to sanitize entire RO Water loop distribution system with Minncare cold sterilant.

B. Storage tanks shall be filled, diluted to 1 percent concentration, recirculated for 4 hours and drained completely.
   1. Each RO water spigot shall be opened and tested for proper concentration.
   2. Entire system shall be rinsed with RO water until there is no disinfectant residual detected at each spigot.
   3. Place system into service by a qualified service technician with a minimum 5 years experience with deionized water equipment.

C. After the system is certified clean, then install new filters in addition to the spare filters for the Owner.

3.2 INSTALLATION OF WATER TREATING SYSTEM

A. Covered under this Section of the specifications is the actual delivery of water treating equipment, installation materials and related supplies, unpacking of equipment, installing equipment, commissioning the system, instructing owner personnel as relates to operation and maintenance of the system.
B. The actual supplier of the Water treating Equipment shall be fully responsible to the General Contractor for delivering and installing the water treating system.

C. All electrical wiring between control panel and system related motors, level controllers, monitors, and all other RO water system components shall be the responsibility of this contractor. Coordinate work with Division 26 Electrical Sections.

D. Equipment Delivery: The equipment supplier/installer shall be responsible for delivery, unpacking and inspecting of all items relating to the water treating system.
   1. All equipment materials and supplies are to be new and where practical delivered to the job site in the manufacturers/suppliers shipping containers, with all items subject to inspection and acceptance by the General Contractor and Owners Representatives.

E. Equipment Placement: The equipment shall be placed and designated by the drawings and specifications or as directed by or accepted by the General Contractor.

F. Piping/Plumbing of Equipment: The actual piping of the system from the inlet to the pre-filters of the system to the outlet of the system post-filters shall be the responsibility of the equipment supplier and must be performed by or supervised and directed by a Certified TNRCC Level 3 Operator. The loop piping from the discharge side of the post filters and back to the equipment room shall be the responsibility of the project contractor.

G. Contractor responsible for infrared welding machine and polypropylene piping fusion machine required for installation of complete system.

H. Piping and valves upstream of the RO unit shall be as specified for domestic cold water. Piping and valves from the outlet of the RO unit and throughout the system shall be polypropylene or PVDF, as specified herein. Strictly follow pipe manufacturer's recommendations and guidelines for installation of piping system.

I. Commissioning of the Water Treating System: The supplier of the water treating system shall be fully responsible for final checkout of the installed system, shall start the system into operation, and verify performance. All pieces of equipment shall be fully filled or loaded with consumables (salt, filter cartridges, batteries, bulbs, fuses, etc.).

J. Performance Verification and Assurance:
   1. The supplier/installer of the water treating system shall verify the testing and monitoring that the system is reliably producing RO water at the outlet of the final filters.
   2. Signal DDC EMS upon low conductivity alarm condition.
   3. The equipment supplier/installer shall be responsible for follow-up responsibility of correcting any failure of the system caused by inferior equipment or workmanship for a period of one full year from successful start-up of the system when operated in accordance with instructions provided by the equipment supplier/installer.
   4. Contractor shall certify in writing, to Owner, that the system meets the specified parameters.

3.3 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to and of material same as, or compatible with, piping may be used in applications in this article, unless otherwise indicated.
3.4 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of reverse-osmosis-water piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Refer to Section 22 0500, Common Work Results for Plumbing, for general piping installation requirements.

3.5 JOINT CONSTRUCTION

A. Refer to Section 22 0500, Common Work Results for Plumbing, for basic piping joint construction. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Piping Joints: Make heat-fusion joints similar to procedure in ASTM D 2657 for polyolefin piping joints.

C. Joint dissimilar pipe materials with transition fittings compatible with pipe materials being joined.

3.6 VALVE INSTALLATION

A. Install sectional valves close to mains on each branch and riser serving equipment.

B. Install shutoff valve on each supply to equipment.

3.7 FIELD QUALITY CONTROL

A. Test new piping and parts of existing piping that have been altered, extended, or repaired, for leaks and defects.
   1. Schedule tests and their inspections by authorities having jurisdiction, with at least 24 hours' advance notice.
   2. Do not cover or put into service before inspection and approval.
   3. Test completed piping according to authorities having jurisdiction. If authorities having jurisdiction do not have published procedures, perform tests as follows:
      a. Hydrostatic Tests: Test piping at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.
   4. Replace leaking joints with new materials and retest until no leaks exist.
   5. Submit separate reports for each test.

3.8 CLEANING

A. Use procedures prescribed by Owner or, if not prescribed, use procedures described below:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

B. Clean piping by flushing with system reverse osmosis water.
3.9 DEMONSTRATION AND TRAINING

A. The supplier/installer of the water treating system shall provide for owners/operators a quantity of six Instruction Manuals covering all major components of the system, with a parts breakdown of each, along with a priced list of recommended spare parts and consumables.

B. The owner/operator personnel shall be provided with a 4-hour session of training as soon as can be mutually arranged after equipment commissioning and a follow-up 4-hour training session within the next 90 days.

END OF SECTION
SECTION 23 0010
MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Except as modified in this Section, General Conditions, Special Conditions, applicable provisions of Division 01, General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23.

B. Applicable provisions of this Section apply to all Sections of Division 23 HVAC.

C. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements, and provide coordination drawings.

D. All work in these Sections shall be installed by craftsmen skilled in their trade.

1.2 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, 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 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. Furnish: The term "furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. Install: The term "install" is used to describe operations at project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. Provide: The term "provide" means to furnish and install, complete and ready for the intended use.
1.3 CODE REQUIREMENTS AND PERMITS

A. Perform work in accordance with applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.

B. Resolve any code violation discovered in contract documents with the Engineer prior to award of the contract. After award of the contract, make any correction or addition necessary for compliance with applicable codes at no additional cost to Owner.

C. Obtain and pay for all permits and inspections.

D. The following building codes are applicable to this project.
   1. 2015 International Mechanical Code
   2. 2015 International Building Code
   4. State Energy Conservation Office (SECO) mandated state building compliance with ASHRAE 90.1-2013

1.4 REFERENCES

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, AWWA Specifications, Federal Standards or other standard specifications must comply with latest editions except where specified otherwise in individual Sections, revisions, amendments, or supplements in effect on date bids are received.

B. Requirements in reference specifications and standards are minimums for all equipment, materials and work. In instances where capacities, size or other features of equipment, devices, or materials exceed these minimums, meet listed or shown capacities.

1.5 SUBMITTALS

A. Equipment and Materials submittals must show sufficient data to indicate complete compliance with contract documents as follows:
   1. Proper sizes and capacities.
   2. That the item will fit in the available space in a manner that will allow proper service.
   3. Construction methods, materials, and finishes.

B. Material and Equipment List: Within 30 days after award of the contract and before orders are placed or shop drawings are submitted, submit a list of equipment and principal materials specified. Give names of manufacturers, catalog and model numbers, and such other supplementary information as necessary for identification.

C. Material and Equipment Shop Drawings: Submit all detailed shop drawings, descriptive literature, physical data, and performance data for review for items of equipment and for principal materials proposed for installation. HVAC controls may be submitted separately provided the controls submittal is complete and coordinated with all other applicable trades. Include identifying symbols and equipment numbers used in plans and specifications, with reference to specification paragraphs, and drawing numbers of all equipment and material submitted.
D. Final Submittal: In addition to number of copies of shop drawings and other data required for review submittals, maintain a separate file of final approved copies of such material. Deliver approved copies in a hard-back binder for the Owner's use. Incorporate changes and revisions made throughout construction period. Delivery of approved copies is a condition of final acceptance for the project.

E. Contractor's Check: Shop drawings will be submitted only by the Contractor. Indicate by signed stamp that the drawings have been checked, that the work shown on the drawings is in accordance with contract requirements and that dimensions and relationship with work of other trades have been checked. If drawings are submitted for approval that have not been checked and signed by the Contractor, they will be returned for checking before being considered by the Architect/Engineer.

F. Refer to Section 01 33 00 for additional submittal requirements

1.6 COORDINATION DRAWINGS

A. Prior to starting work, the Contractor shall provide coordination drawings for all areas of the building. The Contractor shall submit the coordination drawing for confirmation of the coordination process. The Contractor is responsible for all trade confirmation.

B. CAD. Provide 1/4 inch scale coordination drawings.
   1. Drawings shall show all equipment, ductwork, cable trays, fire protection system, coil pull spaces, chilled water, heating water and condensate piping and trap, electrical conduit, electrical and control panels, etc. installed in mechanical room to verify space allocation and coordination of trades.
   2. Provide plan and elevation views detailing installation.
   3. Drawings shall include 1/4 inch scale drawing of each mechanical room. Drawing shall show coil pull spaces and coordination of all ductwork, all chilled water, heating water and condensate piping and trap, electrical conduit, electrical and control panels, etc. installed in mechanical room. Provide plan and elevation views detailing installation
   4. Contractor may not proceed with construction of MEP systems until trade coordination process has been demonstrated to be completed by the Contractor to the Architect, Engineer and Owner.

1.7 INTERFERENCE DRAWINGS

A. Interference drawings are drawings that indicate conflict between the various systems and other components of the building such as beams, columns, walls, etc. They shall be drawn to scale and shall include plans, elevations, sections and other details as required to clearly define the interference and to indicate the contractor's proposed solution.

B. They shall be submitted for approval whenever job measurements and an analysis of the drawings and specifications by the contractor indicate that the various systems cannot be installed without significant deviation from the intent of the contract. When such interference is encountered, work shall cease in the general area of the conflict until a resolution to the question has been approved.
1.8 GUARANTEE
   A. Guarantee work for one year from the date of final acceptance of the project. During that period make good any faults or imperfections that may have arisen due to defects or omissions in materials or workmanship.

1.9 SERVICE
   A. Perform service work required during the guarantee period including lubrication of bearings. Perform manufacturer’s recommended monthly service and provide Owner with written report. Cleaning of air filters and pipe strainers is not included.

1.10 RESOLUTION OF CONFLICTS
   A. Where conflicts may exist between and/or within the drawings and/or specifications, the higher quality, greater quantity, more restrictive, and/or more expensive requirement shall be required and shall be the basis of Contractor pricing. The Contractor shall notify the A/E for resolution of the issue prior to executing the work in question.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT
   A. Furnish new and unused materials, pipes, pipe fittings, and equipment of domestic manufacture, where available. Where two or more units of same type or class of equipment are required, provide units of a single manufacturer.

2.2 ACCEPTABLE MANUFACTURERS
   A. Acceptable manufacturers are listed in individual Sections of Division 23. Where two or more units of same type or class of equipment are required, provide units of a single manufacturer.
   B. Manufacturers’ names and catalog numbers specified under Sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition.
   C. Equipment of similar design, equal to that specified, manufactured by a manufacturer named in the acceptable manufacturers’ list will be acceptable on approval.
   D. Substitutions:
      1. If the Contractor desires to substitute a material or method as an equal to the specified item, he shall request permission from the Architect/ Engineer, in writing, and shall include such literature, samples, etc., deemed necessary to establish the equal quality of his proposal.
      2. If the Architect/Engineer deems it necessary in order to establish the equality between two or more products, he may require laboratory testing at the Contractor’s expense in order to obtain information upon which to base a decision.
3. The Architect/Engineer will not give approval to material salesmen or subcontractors, and only in writing to the successful Contractor after the project has been awarded.

4. For each proposed substitution product, clearly show how the proposed product meets the requirements of the specifications, including performance.

5. No substitution will be considered unless it is presented in writing within that number of days after Notice to Proceed equal to 15 percent of the contract time.

6. Proposers of substitute products shall present samples, literature, test and performance data, record of other installations, names of Owners, architects, engineers, contractors and subcontractors as references, statement of current financial condition, and other technical information applicable to their products, to aid in determining the worth of the substitute product offered in relation to the material and work specified from the standpoint of the Owner's best interest. Substitute materials and products shall be used only if approved in writing by the Architect/Engineer in advance.

7. Approval of substitute materials offered shall not be a basis for contingent extra charges because of changes in other work or related work, such as roughing-in, electrical, structural or architectural, which may result from the substitution.

8. For any Contractor initiated substitutions or changes, Contractor shall be responsible for achieving results equal to or better than the product or design originally specified.

E. Basis of Design: Where a basis of design is indicated (i.e., scheduled products), that product was used for the purposes of established space requirements, structural design for the building, utility connections, etc. If the contractor elects to furnish a product other than the basis of design product (either another named acceptable manufacturer or via substitution) the contractor is responsible for any construction or design costs associated with the non-basis of design product.

2.3 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions without cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate (without cost to the Owner) that equipment performs within designated vibration limits indicated in the specifications, or as specified by manufacturer.

B. Seal all wall and partition penetrations (the penetration opening shall be one inch larger than penetrating member) by ducts and piping by stuffing the annular void with fiberglass insulation and then caulking over fully with a non hardening acoustical caulking applied to both sides of wall or partition.

2.4 PIPE STRAINERS

A. Immediately prior to final acceptance of project, inspect, clean and service hydronic system strainers.

2.5 ACCESS DOORS

A. Provide access doors for all walls or ceiling locations as required for access to valves, controls, regulating devices, water arresters, fire dampers, air distribution boxes, and other concealed
equipment requiring maintenance adjustment or operation. Coordinate location with General Contractor.

B. Refer to architectural Sections for access door requirements.

2.6 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials and adhesives incorporated in this project shall conform to NFPA Standard 255, "Method of Test of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cooperation with Other Trades: Cooperation with trades of adjacent, related, or affected materials or operations and of trades performing continuations of work under subsequent contract is considered a part of this work in order to effect timely and accurate placement of work and to bring together in proper and correct sequence the work of such trades.

B. Workmanship: Work must be performed by workmen skilled in their trade.

C. Installation of all equipment and materials must be complete. Installation shall meet requirements of specifications and manufacturer's recommendations.

D. Electrical Wiring of Motors and Equipment. The Contractor shall note that the electrical design was based upon the mechanical equipment indicated on the mechanical construction documents and specifications. If Contractor proposes any mechanical equipment that requires changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.

3.2 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work, including clearances required for service, in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.

B. The following space allocation and coordination shall be followed, unless otherwise indicated on the construction drawings:

1. Gravity-fed plumbing and roof drain line shall take priority over all other systems.
2. Light fixtures and cable tray arrangements shall take priority in spatial layout. In areas with ceilings, other systems shall be routed above the light fixtures, and offset from above cable tray allowing for access and maintenance clearance.
3. Install HVAC ductwork as close to the bottom of structural framing as possible while allowing clearance for installation of insulation wrap. Install ductwork to be accessible from the ceiling plane.
4. Install HVAC chilled/hot water piping in the plane directly below HVAC ductwork unless indicated otherwise on drawings.
5. Install fire sprinkler piping in the plane directly beneath the HVAC chilled/hot water piping. Do not install sprinkler piping directly below equipment requiring maintenance.
6. Install domestic hot and cold water in the plane directly above the light fixtures.
7. Refer to Division 26 for electrical and control wiring requirements.
8. Install piping to permit removal of coils at air handling units and to permit access to all terminal unit components.

3.3 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.

B. Before any cutting or trenching operations are begun, verify with Owner's Representative, utility companies and other interested parties that all available information has been provided. Verify locations given.

C. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

D. Assume total responsibility for and repair any damage to existing utilities or construction.

3.4 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment and piping are specified under other divisions. However, drawings and layout work for exact size and location of all such openings are included under this division.

3.5 ACCESS DOORS

A. Coordinate location of access doors for ease of operation and maintenance of concealed equipment.

3.6 DELIVERY, STORAGE AND HANDLING

A. Adequately protect work, equipment, fixtures and materials from damage during storing, installation, start-up and testing.

B. Cover all equipment stored exposed to elements with waterproof tarps, provide adequate ventilation.

C. At work completion, all work must be clean and in like new condition.

D. Storage of all mechanical equipment, piping materials and ductwork shall be in strict accordance with manufacturers written installation instructions.
E. Provide factory installed pipe caps for all pipes to be installed on the project.

F. Provide covers over all openings in ductwork stored or installed on the project.

3.7 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections for 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.

C. Pipe Coding:
   1. Paint all piping white. Each line shall receive pipe marker as specified.
   2. Paint pipe in accordance with the following painting schedule:

<table>
<thead>
<tr>
<th>Item</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated Water</td>
<td>Federal Safety White</td>
</tr>
<tr>
<td>Drain and Exhaust</td>
<td>Navy Gray</td>
</tr>
<tr>
<td>Caustic</td>
<td>Federal Safety Red</td>
</tr>
<tr>
<td>Acid and Chemical</td>
<td>Federal Safety Purple</td>
</tr>
<tr>
<td>Chilled Water</td>
<td>Cascade Green</td>
</tr>
<tr>
<td>Condenser Water</td>
<td>Federal Safety Green</td>
</tr>
<tr>
<td>Air</td>
<td>Marlin Blue</td>
</tr>
<tr>
<td>Anything Hot</td>
<td>Federal Safety Orange</td>
</tr>
</tbody>
</table>

3.8 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: 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.
   1. Do not use impact-type equipment except where specifically acceptable to the Architect/Engineer.
   2. Core drill openings in precast concrete slabs for pipes, conduits, outlet boxes, etc., to exact size.

C. Restoration: Restore all openings to "as-new" condition under the appropriate Specification Section for the materials involved

D. Match remaining surrounding materials and finishes.

E. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry.
F. Provide adequate support during cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect/Engineer.

G. Special Note: No cutting, boring, or excavating which will weaken the structure shall be undertaken.

3.9 TEMPORARY CONDITIONING OF BUILDING SPACES FOR COMPLETION OF CONSTRUCTION

A. The following mechanical system items shall be completed prior to operating boilers to produce heating hot water:
   1. All hot water piping systems must be complete.
   2. All hydronic-piping systems must be cleaned in accordance with specifications.
   3. All pumps, air handlers and other associated equipment must be installed in their permanent location with all valves, strainers, piping, vibration isolation, electrical connections and safety devices in place.
   4. Controls to regulate temperature and water flow must be in place and operational.
   5. Provide and service fine mesh construction inserts in pump strainers.

B. Do not operate exhaust devices, including fume hoods, during gypsumboard finishing.

C. A preliminary air balance of the supply air shall be performed within one week of start-up by the TAB firm.

D. Prior to final inspection, clean all equipment inside and out to a like new condition in preparation for final inspection by Owner.

E. All warranties will be commenced at the time of final acceptance.

3.10 OPERATING TESTS

A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation witnessed by Owner's Representative.

B. Prove operations of control systems and all safeties and alarms.

C. Make adjustments as required to ensure proper functioning of all systems.

D. Special tests on individual systems are specified under individual Sections.

3.11 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish copies of commercially available standard operation and maintenance data, including operating instructions, maintenance instructions and parts listings in accordance with Specification 01 78 23. Detailed requirements for these items are as follows:
   1. Information required for the preparation of O&M manuals may be furnished in the form of manufacturers’ standard brochures, schematics, and other printed instructions. Clearly
distinguish between information which applies to the equipment and information which
does not apply. Data shall include as a minimum the following items:

a. Recommended procedures and frequencies for preventive maintenance;
inspection, adjustment, lubrication, cleaning, etc.
b. Special tools and equipment required for testing and maintenance.
c. Parts lists reflecting the true manufacturer’s name, part number and nomenclature.
d. Recommended spares by part number and nomenclature and spare stocking
levels.
e. Integrated mechanical and electrical system schematics and diagrams to permit
operation and troubleshooting after acceptance of the system.
f. Troubleshooting, checkout, repair and replacement procurement procedures.
g. Operating instructions including start up and shutdown procedures.
h. Safety considerations including load limits, speed, temperature and pressure.

2. Provide O&M manuals for all HVAC equipment.

3.12 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints of the contract drawings for the sole
purpose of recording the “as-built” changes and diagrams of those portions of work in which
actual construction is significantly at variance with the contract drawings.

B. Mark the drawings with a colored pencil.

C. Prepare, as the work progresses and upon completion of work, drawings clearly indicating
locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as
installed.

D. At conclusion of project, obtain without cost to Owner, reproducibles of original mechanical
drawings and transfer as-built changes to these.

E. Delivery of as-built prints and reproducibles is a condition of final acceptance.

END OF SECTION
SECTION 23 0020
MECHANICAL DEMOLITION

PART 1 - GENERAL

1.1 WORK INCLUDED
   A. Mechanical demolition for remodeling and work within existing buildings.

1.2 RELATED DOCUMENTS
   A. The requirements of the General Conditions, Supplementary Conditions, Division 01, and
   Drawings apply to all Work herein.

   B. Requirements of the following Division 23 Sections apply to this section:

1.3 SCOPE
   A. Existing buildings and their facilities must remain functional while the Work under this Contract
   is performed. All system shutdowns and outages must be minimized.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT
   A. Materials and equipment for patching and extending work: as specified in individual Sections.
   B. Provide all materials necessary for work.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. All demolitions or modifications to existing systems shall be coordinated through Owner's
   Representative. Demolition drawings are based on field observation and existing record
   documentations. Therefore, the accuracy or exactness of the drawings is not guaranteed. The
   Contractor shall verify that field measurements and routing arrangements are as shown on
   Drawings and abandoned infrastructure and equipment serve only abandoned facilities. The
   Contractor shall be responsible for reporting discrepancies to Engineer before disturbing
   existing installation.
B. Beginning of demolition means Contractor accepts existing conditions.

3.2 PREPARATION

A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal. Provide temporary piping, ductwork and connections to maintain remaining systems in service during demolition and/or modification. Owner reserve the right up to 24 hours prior to any scheduled event to delay or suspend shutdowns or outages to more convenient times at no additional cost.

B. Existing Mechanical Service: Maintain existing systems not scheduled for demolition in operational condition.

C. Where owner allows existing mechanical systems to be used during demolition and renovation, it is the contractors’ responsibility to protect these systems from debris generated by the work process by means of temporary filters and strainers. In addition, at the completion of the project the contractor must repair/replace any damaged equipment and clean the equipment at no cost to the owner. The contractor is responsible for maintaining water treatment in the same or better condition than before the systems were turned over. The contractor is responsible for any treatment required prior to draining piping to prevent corrosion.

3.3 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. General:

1. During the construction and remodeling, portions of the project shall remain in service. Construction equipment, materials, tools, extension cords, and similar items shall be arranged so as to present minimum hazard or interruption to the occupants of the building. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch, or replace, as required, any damage that might occur as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction. Cooperate with the Owner and other trades in scheduling and performance of the work.

2. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap piping with same or compatible piping material.
   c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible ductwork material.
   d. Ducts to Be Abandoned in Place: Cap ducts with same or compatible ductwork material.
   e. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   f. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   g. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
   h. All piping and ductwork that is not to be reused shall be removed back to the nearest main and capped with similar material.

3. Where piping or ductwork is removed, repair insulation where existing insulation is damaged or where duct/pipe is capped with new products matching existing insulation.
B. Loss or Damage: The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all mechanical services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

C. Operational Continuity: The Contractor shall provide temporary or new services to all existing facilities and utility streams as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

D. Utility Access: Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, air conditioning ductwork and equipment, and similar items to provide this access and shall reinstall same upon completion of work in the areas affected.

E. Demolition of Architectural/Structural Elements: Where partitions, wall, floors, or ceiling of existing construction are indicated to be removed and reinstalled, this Contractor shall remove and reinstall, in locations approved by the Architect, all devices required for the operation of the various systems installed in the existing construction.

F. Scheduled Service Outages: Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two (2) weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, and temporary systems shall be included in the contract amount.

G. Pre-Demolition Salvage Survey: The Contractor shall modify, remove, and/or relocate all materials and items so indicated or as required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Survey the project with the Owner's Representative before demolition begins and determine all materials that the Owner specifically chooses to be salvaged. Pre-establish with the Owner locations where salvaged materials are to be stored. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

H. Relocated Equipment: All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

I. Damaged Materials/Equipment to be Reused: When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.
J. Termination of Utility Services: Service lines and piping to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as herein above specified.

K. Nighttime Shifts: Certain work during the demolition and alteration phase of construction may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate times with the Owner.

L. Include in the contract price all rerouting of existing ductwork, piping, air devices, fixtures, and similar items and the reconnecting of existing fixtures and devices as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Furnish all temporary ductwork and piping, and similar items as required to maintain service for the existing areas with a minimum of interruption.

M. All existing air devices materials, equipment and appurtenances not included in the remodel or alteration areas are to remain in place and shall remain in service.

N. Mechanical equipment and building systems equipment, and similar items which are to remain but which are served by piping that is disturbed by the remodeling work, shall be reconnected in such a manner as to leave it in proper operating condition.

O. Existing registers, grilles, and diffusers shown to be removed and indicated to be reused, shall be cleaned, repaired and provided with such new accessories as may be needed for the proper installation in their new locations.

P. Within the remodeled or alteration areas where existing ceilings are being removed and new ceilings are installed, all existing air devices, other ceiling mounted devices and their appurtenances shall be removed and reinstalled into the new ceiling, unless otherwise shown or specified.

Q. Within the remodeled or alteration areas where existing walls are being removed, all existing fixtures, thermostats, other materials and equipment and their appurtenances shall be removed and relocated if necessary where required by the remodel work either shown or specified.

R. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

S. Equipment, materials or other potential hazards to the public and working occupants of the building shall not be left overnight outside of the designated working or construction areas.

T. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's Representative.

U. Refer to Architectural Demolition and Alteration plans for actual location of wall, ceiling, and similar items being removed and/or remodeled.
V. Drawings do not fully indicate conditions or existing obstructions or utilities. Visit the site and examine work to be removed and become familiar with conditions affecting work.

W. Remove ductwork, piping, controls and equipment including previously abandoned mechanical systems full length from source to device. No re-use of existing materials for new construction is allowed except as specifically outlined in the construction documents.

X. Maintain access to existing mechanical installations that remain active.

Y. Within the renovation or alteration areas where existing ceilings are being removed and new ceilings are installed, all new air devices shall be provided.

3.4 DISPOSITION OF MATERIAL AND EQUIPMENT

A. Review with the Owner materials that have been removed and are no longer required, to determine any which the Owner may desire to keep. Deliver those materials that the Owner desires to the Owner’s specified location.

B. For those materials not required by the Owner, dispose of them in accordance with all applicable regulations.

END OF SECTION
SECTION 23 0523

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for furnishing and installing heating water piping, valves and appurtenances, including fittings and strainers.

B. Related Sections:
   1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
   2. Section 23 0553, Identification for HVAC Piping and Equipment, for valve tags and schedules.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data showing compliance with requirements of Part 2. Clearly indicate piping, equipment, materials of construction, pressure rating and which options are to be provided.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect all piping, valves, fittings, etc. before installation in accordance with manufacturer’s written instructions.

B. Piping shall be sent from the factory with capped ends and shall be stored on supports off of the ground with ends covered to prevent nesting of insects, birds and other animals, or the accumulation of dirt and debris in and around the piping components.

1.4 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC 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. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
   1. Ball Valves: Provide an insulated stem extension.

F. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Solder Joint: With sockets according to ASME B16.18.
   3. Threaded: With threads according to ASME B1.20.1.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.3 VALVES FOR TERMINAL BOXES (COIL PACK)

A. General. The following products are for terminal boxes and fan coil units with pipe sizes 2-inches and less.

B. Combination Ball Valve w/PT Test Port and Strainer w/blowdown valve. Provide dezincification resistant or forged brass construction, 600-pound, 325F construction with multiple ¼” tapped ports for test plugs or other accessories and union end. Valve shall have blowout proof stem with stainless steel ball. Strainer shall have 20 mesh Type 304 stainless steel screen and ¾” hose bib & cap.

C. Combination Ball Valve w/Memory Stop and PT Test Port. Provide dezincification resistant or forged brass construction, 600-pound, 325F construction with multiple ¼” tapped ports for test plugs or other accessories and union end. Valve shall have blowout proof stem with stainless steel ball.

D. Combination PT Test Port w/Manual Air Vent. Provide dezincification resistant or forged brass construction, 600-pound, 325F construction with multiple ¼” tapped ports for test plugs or other accessories and union end.

E. PT Test Ports. Shall be rated for 1000 psi, 325F with brass body, Nordel check plugs and sealed cap.

F. Stainless Steel Flex Hoses.
   1. Shall be designed for water and conform to ASTM codes E84, with stainless steel outer braid. Hoses 1/2-inch thru 1-inch shall have a Kevlar reinforced EPDM tube core, brass end fittings, and designed for a working pressure of 400 psi, 248F. Hoses 1¼-inches thru 2-inches shall have Rayon reinforced EPDM tube core, brass end fittings, and designed
for a working pressure of 300 psi, 248F. All hoses shall have at least one union or swivel end fitting and be maximum 18-inches in length.

2. Stainless steel flex hoses are not allowed.

G. Manual Air Vents. Shall be of brass construction and rated at 400 psi, 325F.

H. Shaft extensions (2" and smaller). For insulated pipe shall be at least 2¼" tall and constructed of brass with a stationary external shaft housing to ensure vapor barrier seal.

PART 3 - EXECUTION

3.1 STORAGE:

A. Protect all piping, valves, fittings, etc. before installation in accordance with manufacturer's written instructions. All piping shall be sent from the factory with capped ends and shall be stored on supports off of the ground with ends covered to prevent nesting of insects, birds and other animals, or the accumulation of dirt and debris in and around the piping components.

3.2 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.

3.3 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. Provide clearance for access to valves, fittings and equipment for operation and maintenance.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement and with operators and stems upright or horizontal.
F. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

G. All piping shall be clean when it is installed.

3.4 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections at each floor and at branch takeoffs serving equipment, and at other locations as indicated and required for isolation of piping or equipment.

3.5 DRAIN VALVES AND VENTS

A. Install drain valves at all low points and at base of all risers of water piping systems so that these systems can be entirely drained.

B. Install 2 inch drain for 2 inch pipes and larger.

C. Install a line size drain valve for pipes smaller than 2 inches.

D. Provide hose adapter and cap on all drain lines.

E. Provide automatic vents with isolation valves or manual vents at locations as indicated on Drawings and all high points in piping systems.

3.6 TESTING

A. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150-psig minimum, and carefully check for leaks.

B. Remove or isolate valves, expansion joints, strainers and equipment that are rated at pressures less than test pressure.

C. Repair all leaks and retest the system until proven leak tight.

3.7 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.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. Warning tags.
   7. Duct labels.
   8. Access door labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.3 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.

1.4 RELATED WORK

A. Painting. Division 09.
1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 23 0010.

B. Valve Tags
   1. Provide three-ring binder including valve tag information (8-1/2 x 11 inch paper).
   2. Each service shall be individually tabbed in the binder.
   3. For each valve tag, indicate service, function, valve position (NC or NO), floor, room location and nearest column numbers.

C. Equipment Labels
   1. Provide three ring binder including equipment label information (8-1/2 x 11 inch paper).
   2. Each type of equipment (pumps, AHUs, etc) shall be individually tabbed in the binder.
   3. For each item of equipment to be labeled, provide equipment identification number, floor, room location, and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufactures: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Marking Services, Inc.

2.2 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Brass, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 x 3/4 inch.
   3. 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. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: Black.
   3. Background Color: Background to contrast with letter color.
   4. Maximum Temperature: Able to withstand temperatures up to 160°F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 inch x 3/4 inch.
6. 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.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

2.3 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black. (Similar to Sherwin-Williams SW 4090)

C. Background Color: Background to contrast with letter color.

D. Maximum Temperature: Able to withstand temperatures up to 160°F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 inch x 3/4 inch.

F. 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 2/3 to 3/4 the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic.
   1. Labels shall be formed to cover full circumference of pipe and attach to pipe without fasteners or adhesive for pipe smaller than 6”.
   2. Labels for pipe 6” and larger shall be attached to pipe with nylon cable ties.

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.
2.5 DUCT AND ACCESS DOOR LABELS
   A. Identify ductwork and access doors with stencil.
   B. Letter Color: Black. (Similar to Sherwin-Williams 4090)
   C. Lettering Size: At least 1-1/2 inches high.
   D. Paint: Shall meet VOC requirements per Division 09 painting specification.
   E. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
   F. Access Door Label Contents: Identify access doors with indicated equipment to be accessed.

2.6 VALVE TAGS
   A. Provide valves with 1 1/2 inch diameter stainless steel or brass valve tag with stamped and black-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 1/2 inch letters. Service designations shall be approved by Architect/Engineer. Secure tags to valves by use of brass "S" hooks and brass chain. Secure chain to valve by use of copper or monel meter seals.

2.7 PREPARATION
   A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

2.8 EQUIPMENT LABEL INSTALLATION
   A. Install or permanently fasten labels on each major item of mechanical equipment. Use fasteners for all equipment labels where possible. Where it is not possible to use fasteners, use adhesive.
   B. Locate equipment labels where accessible and visible.

2.9 VALVE TAG
   A. Install valve tags for all major valves. This shall include branch isolation and balancing valves, isolation valves for equipment such as air handling units, pumps, chillers, etc.
   B. Do not provide valve tags for isolation valves directly adjacent to fan coil units and terminal boxes.
2.10 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 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. Do not label drain piping where the floor drain is located adjacent to the equipment.

B. Provide pipe labels for the following piping systems:
   1. Heating Hot Water Systems

2.11 DUCT LABEL INSTALLATION

A. Identify ductwork with stencil.

B. Identify exhaust fan number, air handling unit number, service and area served.

C. Locate identification at air handling unit or fan, at each side of penetration of structure or enclosure at each obstruction, every 20 feet on long horizontal runs. Provide identification for the following ductwork:
   1. All exhaust (laboratory) ductwork.
   2. All supply air ductwork served by Air Handling Units
   3. Hot Water Coil: HWC

END OF SECTION
PART 1 - GENERAL

1.1 WORK INCLUDED
   A. This Section specifies the general requirements for furnishing and installing insulation. These requirements apply to all other Mechanical Division sections specifying insulation.

1.2 RELATED WORK
   A. Insulation. Refer to specific sections on individual insulation types.
   B. Section 09900 or 09901, Painting.

1.3 REFERENCE STANDARDS
   A. ASTM International (ASTM).
   B. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).
   C. North American Insulation Manufacturers Association (NAIMA).
   E. National Fire Protection Association (NFPA).
   F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
   G. Underwriter's Laboratories (UL).
   H. Underwriter's Laboratories Environment (UL Environment).

1.4 FIRE HAZARD RATING
   A. All equipment, duct and piping insulation used on the project must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements.
1.5 QUALITY ASSURANCE:

A. Applicator shall be a company specializing in insulation application with minimum 5 years' experience.

B. Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds.

C. Fiberglass products shall have a minimum of 20 percent recycled glass content certified and UL Validated.

1.6 SUBMITTALS

A. Product Data. Submit product data on each insulation type, adhesive and finish to be used in the work. Include manufacturer's installation instructions, list of materials and thickness for equipment scheduled.

B. Samples. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with the work.

C. Shop Drawings: Show details for the following:
   1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   3. Removable insulation at piping specialties, equipment connections, and access panels.
   4. Application of field-applied jackets.
   5. Application at linkages of control devices.
   6. Field application for each equipment type.

1.7 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are listed under individual specification sections.

1.8 INSULATION

A. Insulate in accordance with appropriate specification section.

PART 2 - EXECUTION

2.1 COMMON INSULATION REQUIREMENTS

A. All materials shall be delivered to the site shall be dry, undamaged and maintained in good condition throughout the progress of the project.

B. Insulation shall not be installed until all testing and inspection of pipe, duct, vessel, etc. has been completed and approved by Engineer/Owner’s representative.
C. Insulate valves, fittings, flanges and special items in accordance with appropriate specification section.

D. Replace insulation damaged by either moisture or other means. Insulation which has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also replace any damage caused by the condensation.

E. 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.

F. 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.

G. 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.

H. Install insulation with longitudinal seams at top and bottom of horizontal runs.

I. Install multiple layers of insulation with longitudinal and end seams staggered.

J. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

K. Keep insulation materials dry during application and finishing.

L. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

M. Install insulation with least number of joints practical.

N. Where vapor barrier is indicated, seal joints, duct wrap seams, vapor retarder (ASJ) film seams and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier coating/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 coating/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.

O. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
2.2 ACCESSORIES

A. Installation of accessories such as jacketing, bands, adhesives, insulation shields, coatings, finishes, etc. is specified under individual specification sections.

END OF SECTION
SECTION 23 0713
EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section provides for furnishing and the installation of external insulation on concealed and exposed ductwork, including single wall supply ductwork, outside air ductwork, and relief and return air duct work in non air conditioned spaces and other miscellaneous ductwork. It also includes insulating the tops of all supply diffusers.

B. All the ductwork exposed to view in public spaces, in mechanical and pump rooms, crawl space and equipment rooms including all areas without ceilings is to be considered as exposed ductwork.

C. Consider space above ceilings air conditioned if floor above is air-conditioned or if the space is a return air plenum.

D. No lined ductwork is allowed on the project unless specifically noted on drawings or in the specifications.

1.2 RELATED WORK

A. Section 23 0700, Insulation - General.

B. Section 23 3113, Ductwork.

1.3 REFERENCES STANDARDS

A. ASTM C 411 - Temperature Range.

B. ASTM C 553 - Mineral Fiber Blanket and Felt Insulation.

C. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation.

D. ASTM C 1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts

E. ASTM E 96 Procedure A - Jacket Vapor Transmission.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fiberglass:
   1. CertainTeed.
   2. JohnsManville.
   3. Owens-Corning.

2.2 INSULATION

A. Type D1, Flexible Glass Fiber Insulation: Provide flexible glass fiber insulation; bonded with a formaldehyde free thermosetting resin, with factory-applied, reinforced foil scrim kraft (FSK) facing vapor barrier, 1.0- pound per cubic foot density. A “K” factor of 0.27 at 75°F mean is required. Shall comply with ASTM C553, Types I, II and III, ASTM C 1136, Type II and ASTM C1290, Type III.

2.3 COATINGS AND ADHESIVES

A. Glass Fiber Insulation
   1. Coating. Foster 30-80 or Childers CP-38 vapor barrier coating. Permeance shall be 0.05 perms or less as tested by ASTM E96, Procedure A at 47 mils dft or 0.08 perms or less as tested by ASTM F1249. Coating must comply with MIL-PRF-19565C, Type II and be QPL listed.

B. Reinforcing Mesh. Fiberglass or polyester, 10 strands by 10 strands per square inch. Similar to Foster Mast A Fab or Childers Chil Glas #10.

2.4 FACTORY-APPLIED JACKETS

A. FSK Jacket: Aluminum foil, fiberglass reinforced scrim with kraft paper backing; complying with ASTM C 1136, Type II.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not apply insulation until ductwork has been tested.

B. Verify surfaces are clean, foreign material removed, and dry.

C. Where trapeze hangers are used, provide strip of non-compressible insulation between ductwork and hanger. Refer to detail on drawings.
3.2 FIRE SAFETY REQUIREMENTS

A. Do not extend duct coverings through walls or floors required to be fire stopped or required to have fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heaters.

3.3 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
1. Indoor, concealed supply and outdoor air ductwork.
2. Indoor, exposed supply and outdoor air ductwork.
3. Indoor, concealed or exposed return and exhaust ductwork located in nonconditioned spaces.
4. Indoor, concealed & exposed return air ductwork, from connection of outside air ductwork to air handling unit.

B. Air Devices:
1. Supply Diffuser.
2. Uninsulated Plenums on Slot Diffusers and Linear Bar Grilles.

C. Items Not Insulated:
1. Indoor, concealed return air ductwork (in chases, above ceilings, except as noted above).
2. Indoor, exposed return air ductwork (in chases, mechanical rooms except as noted above).
3. Flexible connectors.
4. Double wall ductwork.

D. Definitions
1. Oval ductwork shall be insulated the same as round ductwork.
2. Outside air duct shall be considered ductwork (or plenum) from louver or intake hood to air handling unit.

3.4 DUCTWORK INSULATION APPLICATION AND THICKNESS SCHEDULE

A. Provide insulation with minimum thickness and installed “R” valves in accordance with ASHRAE Standard 90.1-2013 Tables 6.8 2A & B, but not less than thickness specified in this specification and as required to prevent condensation:

<table>
<thead>
<tr>
<th>Ductwork System</th>
<th>Application</th>
<th>Insulation Type</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Air – Rectangular/Round</td>
<td>Concealed Ductwork</td>
<td>D1</td>
<td>2”</td>
</tr>
<tr>
<td>(Hot, Cold, Combination)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Devices</td>
<td>Where Scheduled</td>
<td>D1</td>
<td>1”</td>
</tr>
</tbody>
</table>
3.5  TYPE D1, FLEXIBLE GLASS FIBER INSULATION

A. Insulation shall be wrapped, in accordance with manufacturer's recommendations, on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2 inches.

B. Adhere insulation to ductwork with 4 inch wide strips of adhesive at 8 inches on center. In addition, secure insulation to the bottom of rectangular horizontal ductwork and on vertical ductwork over 24 inches wide by the use of mechanical fasteners at no more than 18 inches on center. Weld stick clips to duct work to secure insulation. Adhesive applied stick pins are not acceptable.

C. On circumferential joints, the 2 inch flange on the facing shall be stapled with outward clinching steel staples on 2 inch centers, and taped with a minimum 3-inch-wide strip of reinforcing mesh and vapor barrier coating. Cover all seams, joints, pin penetrations and other breaks with two coats of vapor barrier coating reinforced with reinforcing mesh. Coating shall completely cover and conceal mesh.

3.6  STANDING SEAMS

A. Insulate standing seams and stiffeners which protrude through insulation with 3-pound density, 1-1/2 inch thick, faced duct insulation, flexible blanket or rigid insulation to match duct insulation. As a vapor seal on exposed edges, use glass cloth with vapor barrier coating. Insulation should not prevent adjustment of damper operators.

3.7  AIR DEVICES

A. Insulate backside of diffusers and uninsulated plenums on slot diffusers as indicated in application schedule.

B. All edges of insulation should be taped to diffuser backpan with pressure-sensitive aluminum foil tapes listed and labeled under UL 181A, Part I.

3.8  TRANSFER DUCTS

A. Line return air transfer ducts with 1/2 inch dual density type acoustical insulation. Coat exposed edges of insulation with sealant.

3.9  HEATING COILS

A. Install insulation on terminal box heating coil casings same as specified for adjacent ductwork.

END OF SECTION
SECTION 23 0719

PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Piping insulation for Heating Water Piping within building envelope.
   2. Furnishing and installation of insulation.

1.2 REFERENCES

C. ANSI/ASTM C 552 - Cellular Glass Block and Pipe Thermal Insulation.
D. ASTM B 209 - Aluminum and Aluminum-alloy Sheet and Plate.

1.3 QUALITY ASSURANCE

A. Applicator. Company specializing in piping insulation application with five years minimum experience.
B. Materials. UL/ULC Classified per UL 723 or Flame spread/fuel contributed smoke developed rating of 25/50 in accordance with ASTM E84.

1.4 SUBMITTALS

A. Refer to Specification 23 07 00.
B. Submit product data on insulating materials, including manufacturer’s safety and installation instructions.
C. Include product description, list of materials and thickness for each service, and locations.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
   1. Fiberglass
      a. Owens-Corning.
      b. JohnsManville.
      c. Knauf Insulation
   2. Flexible Elastomeric
      a. Armacell; AP Armaflex.
      b. K-Flex USA.

2.2 INSULATION

A. Type P1: Furnish fiberglass insulation, bonded with a bio-based, formaldehyde free thermosetting resin, with factory applied, all service reinforced vapor barrier (ASJ or ASJ+) jacket having integral laminated aluminum vapor barrier and self sealing labs (SSL or SSL+). Jacketing shall have a maximum water vapor permeance of 0.02 perms. Insulation shall be in accordance with ASTM C585, STM C411, ANSI/ASTM C 547 with a "K" factor of 0.23 BTU-in/hr-ft2-°F at 75°F. Insulation shall be certified by Greenguard Gold.

B. Type P2. Furnish closed-cell expanded rubber materials complying with ASTM C534, Type 1 for tubular materials or ASTM C534, Type 2 for sheet materials. Insulation shall have a maximum "K" factor of 0.28 Btu-in./h-ft2- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.

2.3 INSULATION SHIELDS AND SADDLES

A. Field Fabricated:
   1. Use high compression strength Phenolic Foamglas blocks (HLB 1600) that will support the bearing area at hangers and supports.
   2. Further support insulation at hangers and supports with a shield of galvanized metal extending not less than 2 inches on either side of the support bearing area, covering at least half of the pipe circumference, and conforming to the schedule below.
   3. When pipe is guided at top and bottom, metal shields should cover the whole pipe circumference.
   4. Adhere metal shield to insulation so that metal will not slide with respect to insulation. Furnish vapor barrier and sealant where used on low temperature service (below 100°F).

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Insulated Section Length in Inches</th>
<th>Minimum U.S. Standard Gauge of Metal Shield</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1/2” and smaller</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>3” to 4”</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>6” to 12”</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>14” and larger</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>
5. At Contractor’s option, factory-made insulation shields may be provided as made by Anvil Fig 168, equivalent by Pipe Shields, Inc., or equal. Insulation should extend at least 1 inch beyond metal. Select proper shield for service and pipe span.

6. For Type P2 insulation, factory-made insulation shields such as Armafix IPH may be used at Contractor’s option.

B. All shields are to be secured by 2 stainless steel bands, 1/2 inch wide by 0.015 inch thick with matching seals

2.4 JACKETS

A. PVC Jackets: Provide molded or mitered covers for flanges, valves and fittings similar to PROTO or Johns Manville Zeston 2000.

B. Canvas or Glass Jackets and Lagging Adhesive/Coating: UL listed treated cotton fabric, 6 ounce/square yard or low odor glass cloth, Childers CP-50AMV1, Fosters 30-36 lagging adhesive or approved equal

C. Factory-Applied Jackets


2. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM 1136 Type I, II, III, IV and VII.

3. ASJ: White, kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.

4. ASJ-SSL: ASJ with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.5 SEALANT, ADHESIVE AND FINISH

A. Fiberglass - High Temperature (Above 100ºF):

1. Furnish Childers CP-82 or Foster 85-20 to seal longitudinal laps of the vapor barrier jacket and to adhere butt joint covers.

2. Finish: Furnish Childers CP-10/11 or Foster 46-50 weather barrier mastic with reinforcing mesh.

3. Cement: Furnish Ryder One Coat on insulated fittings, flanges and valves.

4. Primer and Finish: Furnish Childers CP-50A MV1 diluted 50% with water to prime cement prior to applying coating.

5. Lagging Adhesive: Used in conjunction with canvas or glass lagging cloth to protect equipment/piping indoors. Foster 30-36 Sealfas, Childers CP-50AMV1 Chil Seal or approved equal.

B. Flexible Elastomeric

1. Adhesive: Furnish Armaflex 520 BLV Low VOC Adhesive, Foster 85-75, or Childers CP-82 to seal longitudinal labs and to adhere butt joint covers.

2. Finish: Furnish Armaflex WB or Foster 30-64 water based latex enamel finish.
2.6 FITTINGS

A. Provide pre-molded fittings and elbows molded in two matching half sections of same insulation thickness as adjoining piping. As an alternative, provide mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs. No insert or blanket insulation allowed.

2.7 PRIMER

A. Polyguard RG-CHW for surface temperatures less than 130°F, RG-2400 LT for piping with surface temperatures between 130°F and 250°F. Application thickness shall be 25 mils.

B. Global Encasement Rust Inhibition Primer. Application thickness shall be minimum 3 mils (dry).

C. Sherwin Williams Pro-Cryl Universal Acrylic Primer. Application thickness shall be minimum 3 mils (dry).

PART 3 - EXECUTION

3.1 PIPE

A. Pressure testing of piping systems shall be complete prior to application of insulation.

B. Prior to insulating piping,
   1. Remove all oil, grease, cutting oils, dirt and other contaminants. Use suitable solvents, steam cleaning with detergent, or fresh water wash with detergent. Follow with thorough fresh water rinse.

C. Butt insulation joints firmly together. Seal longitudinal laps and butt strips with sealant.

D. Type P2.
   1. Provide finish as specified on all insulation.

3.2 VALVES, FLANGES AND FITTINGS

A. High Temperature:
   1. Omit insulation at screwed unions and at valves smaller than 1-1/2 inches.
   2. On concealed piping, insulate fittings and valves 2 inches IPS and smaller with pre-molded fitting covers with a thickness equal to or greater than adjoining straight pipe. Finish with mastic reinforced with reinforcing mesh.

3.3 SHIELDS AND HANGERS

A. Where piping hangers or anchors must be in direct contact with pipe, seal off the pipe insulation on both sides of the hanger by carrying the vapor seal down to the bare pipe. Apply insulation around the hanger ring or anchor and pipe and carry vapor barrier upward and outward along the hanger rod or anchor members to a point not less than 12 inches from the adjacent pipe.
Draw wire loops tight over the vapor barrier jacket, with ends of wire bent down. Take care to avoid puncturing the vapor seal. Finish insulation as specified for flanges, and seal over adjacent vapor barrier jacket.

3.4 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Continue insulation with vapor barrier through penetrations.

C. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

D. Neatly finish insulation at supports, protrusions, and interruptions. Use 1-1/2 inch Type P2 insulation to insulate drains gauges, thermometers, and strainers.

3.5 PIPING INSULATION APPLICATION AND THICKNESS SCHEDULE

A. Provide insulation with minimum thickness and conductivity values in compliance with ASHRAE standard 90.1-2016, Table 6.8.3-1,2, but not less than thicknesses specified in this specification and as required to prevent condensation. Where multiple materials are listed for a single service and location, it is the Contractor's option to choose from the allowable insulations.

<table>
<thead>
<tr>
<th>Service</th>
<th>Location</th>
<th>Insulation Type</th>
<th>Pipe Sizes</th>
<th>Insulation Thickness-Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Hot Water</td>
<td>Interior</td>
<td>P1</td>
<td>1-1/4” and smaller</td>
<td>1-1/2</td>
</tr>
<tr>
<td>Heating Hot Water</td>
<td>Interior</td>
<td>P1</td>
<td>1-1/2” to 4”</td>
<td>2</td>
</tr>
<tr>
<td>Supports, protrusions, drains, gauges, thermometers and strainers</td>
<td>Interior/Exterior</td>
<td>P2</td>
<td>All Sizes</td>
<td>1-1/2</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Furnish and install Air Valves for all laboratory spaces as shown on the drawings. The lab tracking system is to be Bacnet integrated into the existing Building Automation System (BAS).

   B. A laboratory airflow control system shall be furnished and installed to control the airflow into and out of laboratory rooms. The exhaust flow rate of a laboratory fume hood shall be precisely controlled to maintain a constant average face velocity into the fume hood. The system shall have the capabilities to provide constant face velocity control at either a standard / in use or a standby level based on an operator being present in front of the fume hood. The laboratory control system shall vary the amount of makeup/supply air into the room to operate the laboratories at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum ventilation rates, and maintain laboratory pressurization in relation to adjacent spaces (positive or negative). The laboratory airflow control system shall be capable of operating as a stand-alone system, or as a system integrated with the Building Automation System (BAS).

   C. Installation of the air valves is by Division 23. Wiring and interface to the Building Automation System (BAS) is to be furnished by Division 25. Start-up and System Commissioning to be furnished by Divisions 23 and 25.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

   B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

   C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within all references.

1.4 SUBMITTALS
   A. Product Data:
1. Submit product data for valve electronic and electrical components and optional accessories. Each air valve model product name, and model ordering number, design airflow rates and differential pressure requirements across the valve.

B. Record Documents:
1. Submit complete point-to-point wiring diagrams for each applicable room configuration as shown on the Owner’s Drawings.

1.5 WARRANTY
A. Warranty shall commence upon the date of Owner acceptance and extend for a period of twenty-four months, whereupon, any defects in materials or system performance shall be repaired by manufacturer at no cost to the Owner.

B. During the Warranty Period, if a service contract for the routine care, calibration, parts replacement, or upgrade of the system is required or recommended by the manufacturer, or such a contract is to be offered to the Owner during or after the Warranty Period, such contract and services shall also be included during the Warranty Period at no cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 ACCEPTABLE MANUFACTURERS
A. Phoenix Controls Corporation (BASIS OF DESIGN)
B. (CRC) Critical Room Controls (ALTERNATE #1)

2.3 LABORATORY AIRFLOW CONTROL SYSTEM
A. The Laboratory Airflow Control System (LACS) is a microprocessor-based airflow control system that is used for research laboratories and other critical room environments. The LACS shall have a Bacnet™ interface for bi-directional communication with the BAS. The LACS shall provide data values, alarms, and set points used in each room-environment control scheme to the BAS, and also provide remote diagnostics and comprehensive reports and trends through the BAS.

B. Each individual lab zone shall have a dedicated laboratory airflow control system. Each dedicated laboratory airflow control system shall support a minimum of twenty (20) network controlled airflow devices.

C. The laboratory airflow control system shall employ individual average face velocity controllers that directly measure the area of the fume hood sash opening and proportionally control the hood’s exhaust airflow to maintain a constant face velocity over a minimum range of 20% to 100% of sash travel.
D. The hood exhaust airflow control device shall respond to the fume hood sash opening by achieving 90% of its commanded value within one second of the sash reaching 90% of its final position with no more than 5% overshoot or undershoot of the required airflow. Rate of sash movement shall be between 1.0 to 1.5 feet per second.

E. The hood exhaust airflow control device shall have the capability of automatically switching between in-use and standby levels based on operator presence immediately in front of the hood. A presence and motion sensor shall activate the switching. The airflow control device shall achieve the required in-use commanded value in less than one second from moment of detection with no more than a 5% overshoot or undershoot.

F. The laboratory airflow control system shall maintain specific airflow (+/-5% of signal within one second of a change in duct static pressure) regardless of the magnitude of the pressure change (within 0.3 inches to 3.0 inches w.c.), airflow change or quantity of airflow control devices on the manifold.

G. The laboratory airflow control system shall use volumetric flow offset control to maintain room pressurization. The system shall maintain proper room pressurization polarity (negative or positive) regardless of any change in room/system conditions such as the raising and lowering of any or all fume hood sashes or rapid changes in duct static pressure. Systems using room differential pressure measurement or velocity measurement to control room pressurization are unacceptable.

H. The controller shall be integrated via Bacnet™ with the following points as a minimum;
   1. Fume Hood Exhaust Flow (CFM).
   2. Supply/Make-up Airflow (CFM).
   4. Total Lab Exhaust Flow (CFM).
   5. Total Lab Supply Flow (CFM).
  10. Occupied, unoccupied, and emergency modes (command and status) of operation and associated command-able and adjustable points. (e.g. cooling and heating temperature setpoints (unocc/occ), different minimum supply airflow setpoints at various modes, lab airflow offset setpoint, etc.).
  11. Valve static and low flow alarms.

I. The Control Unit shall also accept direct input signals from the BAS.

2.4 FUME HOOD CONTROLLER

A. Linear controller shall be installed on the sash mullion of each hood and shall provide user interface/alarm functions and a linear control system, which translates the sash position into a proportional control signal to modulate the hood’s exhaust air valve. Hood airflow shall be varied to maintain a nominally constant face velocity at the hood opening. No air velocity sensors shall be employed. Hood airflow shall be varied to maintain a constant face velocity over no less than a 5 to 1 change in the sash open area (change in sash position).

B. Fume hood control system shall respond to and maintain the face velocity set point to ensure fume hood containment.
C. Provide a fume hood controller to receive a sash position signal from the sash sensor, process this signal and then output an exhaust airflow control signal to the hood exhaust valve.

D. The face velocity and minimum exhaust flow level of the fume hood shall be set at the fume hood monitor via trim pot adjustments. Accurate adjustments of the face velocity shall be provided at the minimum and maximum sash positions.

E. Fume hood controller shall have a visual and an audible enunciator to alarm the occurrence of a low face velocity. Muting of the enunciator will not cancel the visual alarm until the low flow condition is no longer present. The fume hood alarm shall be initiated by:
   1. A differential pressure switch located across a hood exhaust valve that senses a reduction in airflow of approximately 20 percent of set point.
   2. When the airflow value sent to the hood exhaust valve by the control unit is different than the actual airflow feedback value.
   3. The sash being raised above a specified height and/or specified area for fume hoods not sized for 100 percent opening.
   4. The alarm wire being disconnected.

F. Fume hood controller shall include an LCD readout to indicate face velocity of hood; green LED indication for normal operation, yellow LED and audible alarm for an unsafe flow condition, yellow LED and audible alarm for night energy waste alert and red LED and audible alarm to indicate emergency exhaust operation.

G. A pushbutton switch shall be provided to mute the audible alarms. The mute mode is automatically reset when the alarm condition ceases.

H. Each of the flows and system “offset” shall be adjustable.

I. Momentary or extended losses of power shall not change or affect any of the control system’s set points, calibration settings, or emergency exhaust mode status. After power returns the system shall continue operation exactly as before without need of operator intervention. Under no circumstances shall loss of power command the exhaust system to full flow upon return of power.

J. Control power for the hood controller shall be provided from the supply air control panel.

2.5 FUME HOOD SASH POSITION SENSORS

A. A sash sensor shall be provided to measure hood sash position and output a sash position signal to the hood controller. Sash position sensors shall be provided on both vertical and horizontal overlapping sashes. The sash sensor shall consist of a precision ten turn potentiometer mechanically coupled to a constant tension spring reel. A stainless steel, vinyl-coated cable shall be attached to the spring reel. Expected lifetime based on manufacturer’s component data and tests shall be over 200,000 full height sash movements.

B. The hood sash position sensor shall be designed to meet the UL 913, Class 1, Division 1, Groups C and D, and methane standard for intrinsically safe equipment used in hazardous locations.

2.6 AIRFLOW CONTROL DEVICES (PHOENIX – BASIS OF DESIGN)

A. Venturi Control Devices
1. The airflow control device shall be a venturi valve with an option for 100% shut-off capabilities. The valve assembly manufacturer’s Quality Management System shall be registered to ISO 9001:2000. The valve body is constructed of 16 gauge spun aluminum with continuous welded seam, composite Teflon shaft bearings, and a spring grade stainless steel spring in the slider assembly. Supply valves to be insulated with 3/8” flexible closed cell polyethylene insulation material. Airflow devices have an operating range of 32-122° F ambient at 10-90% RH.

2. The airflow control device shall be pressure independent over its specified differential static pressure operating ranges of 0.3”W.C – 3.0”W.C or 0.6”W.C – 3.0”W.C. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifold system.

3. The airflow control device shall maintain accuracy within ±5% of signal over an airflow turndown range as shown in the table below and stated by the venturi’s original manufacturer’s sizing chart in the “Ideal Selection Range” without exceeding 2000 FPM velocity through any airflow device and have no deviation or loss of accuracy through the entire range of the flow device.

4. Provide medium pressure valves as shown on schedules.

<table>
<thead>
<tr>
<th>Pressure Drop Range</th>
<th>Airflow Turndown</th>
<th>Valve Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6- 3.0 in w.c.</td>
<td>Devices up to 1,000 CFM 20 to 1 Standard</td>
<td></td>
</tr>
<tr>
<td>Medium Pressure</td>
<td>Devices up to 1,500 CFM 16 to 1 Standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Devices up to 2,500 CFM 12 to 1 Standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Devices up to 850 CFM 17 to 1 Shutoff</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Devices up to 1,300 CFM 14 to 1 Shutoff</td>
<td></td>
</tr>
</tbody>
</table>

5. No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.

6. The airflow control device shall maintain accuracy within ±5% of signal over an airflow turndown range without exceeding 2000 FPM.

7. The airflow control device shall be constructed of one of the following three types or classes:
   a. Class A – Body and cone of uncoated aluminum; shaft uncoated stainless steel.
   b. Class B – Body and cone with phenolic coating; PFA coated stainless steel shaft. (For standard Fume Hood, Radioisotope Hood, and Biological Safety Cabinet applications)
   c. Class C – Body, cone and hardware with phenolic coating; PFA coated stainless steel shaft. (For highly corrosive Fume Hood applications)

8. For two-position or VAV operation, an electric actuator shall be factory mounted to the valve. Loss of control power shall cause the actuator to fail in last position. When failed in last position, pressure independent airflow control is to be maintained by the airflow control device during power failure. Electric actuators that fail in last position exclusively are not acceptable. Tracking pair low speed electric actuators fail in last position, but will continue to control air flow and be pressure independent with no power.

9. The controller for the airflow control devices shall be microprocessor based and operate using a peer-to-peer control architecture. The room-level airflow control devices shall function as a stand-alone network or can be fully integrated.

10. The room-level control network shall utilize a Lon Talk peer to peer communications protocol.

11. There shall be no reliance on external or building-level control devices to perform room-level control functions. Each laboratory control system shall have the capability of performing; Fume hood control, Pressurization control, Temperature control, Humidity control, and implement Occupancy and Emergency mode control schemes.
12. The laboratory airflow control systems shall integrate digitally with the BAS through Bacnet™ SIP Ethernet connect.

13. Each airflow control device shall be factory calibrated to the job specific airflow as detailed on the plans and specifications using NIST traceable air stations and instrumentation having a combined accuracy of at least ±1% of signal over the entire range of measurement. Electronic airflow control devices shall be further calibrated and their accuracy verified to ±5% of signal at a minimum of forty-eight different airflows across the full operating range of the device. All flow data for any given device shall be stored at the factory and be available on presentation of the unique serial number within 24 hours. Flow data for all valves shall be stored at a location away from the factory for disaster recovery purposes.

14. All airflow control devices shall be individually marked with device specific, factory calibration data. At a minimum, it should include: tag number, serial number, model number, eight point characterization information (for electronic devices), and quality control inspection numbers. All information shall be stored by the manufacturer for use with record documentation.

15. Valves will be selected and sized to not exceed the flow and pressure ranges in the following table:

<table>
<thead>
<tr>
<th>Description</th>
<th>Size</th>
<th>Operating Range in CFM</th>
<th>Valve Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Single</td>
<td>Dual</td>
</tr>
<tr>
<td><strong>M- Medium Pressure 0.6” – 3.0</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8”</td>
<td>35 – 700</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10”</td>
<td>50 – 1000</td>
<td>100 – 2000</td>
<td></td>
</tr>
<tr>
<td>12”</td>
<td>90 – 1500</td>
<td>180 – 3000</td>
<td></td>
</tr>
<tr>
<td>14”</td>
<td>200 – 2500</td>
<td>400 – 5000</td>
<td></td>
</tr>
<tr>
<td><strong>M- Medium Pressure 0.6” – 3.0</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8”</td>
<td>35 – 600</td>
<td></td>
<td>Shut - Off</td>
</tr>
<tr>
<td>10”</td>
<td>50 – 850</td>
<td>100 – 1700</td>
<td></td>
</tr>
<tr>
<td>12”</td>
<td>90 – 1300</td>
<td>180 – 2600</td>
<td></td>
</tr>
<tr>
<td>14”</td>
<td>200 – 1600</td>
<td>400 – 3200</td>
<td></td>
</tr>
</tbody>
</table>

16. The shutoff airflow control device shall have shutoff and casing leakage of no more than:

<table>
<thead>
<tr>
<th>Static Pressure Across Valve in Shutoff</th>
<th>Airflow</th>
<th>Shutoff Leakage</th>
<th>Casing Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 in w.c.</td>
<td>Shutoff devices up to 850 CFM</td>
<td>6 CFM</td>
<td>0.12 CFM/ ft²</td>
</tr>
<tr>
<td></td>
<td>Shutoff devices up to 1,300 CFM</td>
<td>6 CFM</td>
<td>0.12 CFM/ ft²</td>
</tr>
<tr>
<td></td>
<td>Low leakage shutoff devices up to 850 CFM</td>
<td>0.005 CFM</td>
<td>0.010 CFM/ ft²</td>
</tr>
<tr>
<td></td>
<td>Low leakage shutoff devices up to 1,300 CFM</td>
<td>0.010 CFM</td>
<td>0.010 CFM/ ft²</td>
</tr>
</tbody>
</table>
17. 100% Shut-off sequence can be initiated through a universal input or remotely via the local area network from the BAS or a Local Display Unit. 100% Shut-off confirmation is available through a local digital output or an integrated point. The 100% shut-off confirmation is required by positive position verification.

18. Laboratory spaces that have chemical fume hoods requiring full high-speed actuator capabilities for proper VAV control shall use a system similar to the Phoenix CELERIS system. A system similar to the Phoenix CELERIS system with low speed electric actuation will be used for all Laboratory spaces (including spaces with two or more temperature sensors) with no fume hoods but have additional sequence requirements as noted by the schedules and/or sequence of operation. All other spaces, such as equipment rooms, dark rooms, and environmental rooms, requiring general room pressurization control will utilize a system similar to the Phoenix TRACCEL tracking pair system.

2.7 AIRFLOW CONTROL DEVICES (CRITICAL ROOM CONTROLS – ALTERNATE #1)

A. Blade Damper Control Devices:

1. Laboratory supply terminal (LS)
   a. Venturi Shaped Anemometer – Terminal shall be a venturi shaped anemometer made from 16 gauge aluminum. Damper shall be solid steel driven by stainless steel shaft and Teflon bearings. Airflow pressure pick-ups shall be polymer.

2. Fume hood exhaust valve (LE)
   a. Venturi Shaped Anemometer – Terminal shall be a venturi shaped anemometer made from 18 gauge 316 stainless steel. Damper and shaft shall be stainless steel with Teflon bearings. Airflow pressure pick-ups shall be polymer.
   b. Provide minimum 20 gauge Type 316 stainless steel duct material for all fume hood exhaust terminals (LE) including a stainless steel butterfly blade type damper and actuator.
   c. Each fume hood exhaust terminal will have a factory mounted air flow transmitter with output of 4-20 mA or 0-10VDC proportional to velocity pressure. The air flow transmitter will have an accuracy of at least ±5% of the transmitter range.

3. General Exhaust Valve (GE)
   a. Venturi Shaped Anemometer – Terminal shall be a venturi shaped anemometer made from 16 gauge aluminum. Damper shall be solid steel driven by stainless steel shaft and Teflon bearings. Airflow pressure pick-ups shall be polymer.

4. Actuation:
   a. For electrically-actuated VAV and Constant Air Volume operation, an electronic actuator shall be factory mounted to the valve. Loss of main power shall cause the valve to position itself in an appropriate failsafe state. Options for these failsafe states include: normally open-maximum position, normally closed-minimum position, or last position. This position shall be maintained constantly without external influence, regardless of external conditions on the valve (within product specifications).
   b. High speed electronic actuators
      1) Provide high speed actuators for all supply and exhaust terminal units serving laboratories with fume hoods and laboratories planned to allow for future fume hoods (all support labs).
      2) Performance shall be no less than 53 lb-in with 90 degree stroke in 2 seconds.
      3) Repositioning resolution shall be a minimum of 0.4%.
   c. All actuators shall provide a position feedback that can be displayed on the DDC system.
2.8 CONTROL FUNCTIONS

A. The airflow control devices shall utilize a peer-to-peer, distributed control architecture to perform room-level control functions. Master/Slave control schemes shall not be acceptable. Control functions shall at a minimum include, pressurization, temperature, humidity control and respond to occupancy and emergency control command.

B. Pressurization Control
   1. The laboratory control system shall control supply and auxiliary exhaust airflow devices to maintain a volumetric flow offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure. This offset shall be field adjustable and represents the volume of air, which will enter (or exit) the room from the corridor or adjacent spaces.
   2. The pressurization control algorithm shall sum the flow values of all Supply and Exhaust airflow devices and command appropriate controlled devices to new set points to maintain the desired offset. The offset shall be adjustable through the BAS.
   3. The pressurization control algorithm shall support the ability to regulate the distribution of total supply airflow across multiple supply airflow control devices or total general exhaust airflow across multiple exhaust airflow control devices in order to optimize air distribution in the space.

C. Temperature Control
   1. The laboratory control system shall regulate the space temperature through a combination of volumetric thermal override and control of reheat coils and/or auxiliary temperature control devices. The laboratory control system shall support up to four separate temperature zones for each pressurization zone. Each zone shall have provisions for monitoring up to five (5) temperature inputs and calculating a straight-line average to be used for control purposes. Separate cooling and heating set points for each occupancy mode shall be writable from the BMS, with the option of a local offset adjustment.
   2. Temperature control shall be implemented through the use of independent primary cooling and heating control functions, as well as an auxiliary temperature control function, which may be used for either supplemental cooling or heating. Cooling shall be provided as a function of thermal override of conditioned air with both supply and exhaust airflow devices responding simultaneously so as to maintain the desired offset. Heating shall be provided through modulating control of a properly sized reheat coil.
   3. The auxiliary temperature control function shall offer the option of either heating or cooling mode and to operate as either a stand-alone temperature control loop, or staged to supplement the corresponding primary temperature control loop.

D. Occupancy Control
   1. The laboratory control system shall have the ability to change the minimum ventilation (supply airflow) and temperature control heating and cooling set points, based on the occupied state, in order to reduce energy consumption when the space is not occupied. The occupancy state may be set by either the BAS, as a scheduled event, or through the use of a local occupancy sensor or switch. The laboratory control system shall provide a local occupancy override button that allows a user to override the occupancy mode and set the space to occupied, for a predetermined interval. The override interval shall be configurable for 1 to 1,440 minutes. The local occupancy sensor-switch, or bypass button shall be given priority over a BAS command.
2.9 TERMINAL UNIT CONNECTIONS
   1. Single valve terminal unit duct connections shall consist of round inlet connections suitable for flanged and bolted connection to rigid round duct as detailed on the Drawings. If circular bolt flanges are not noted on the drawings, then the Venturi Valve Draw band Clamp kit shall be utilized on both the inlet and outlet connections to the ductwork. Standard slip-in duct connections with sheet metal screws and sealer is not acceptable. Where multiple valves are employed, a common inlet plate suitable for slip connection to a single rectangular duct inlet duct shall be factory installed on the terminal unit using a press fit and silicone seal connection.

2.10 BAS INTEGRATION
   A. The room controllers shall be capable of direct communications with the existing BAS system via Bacnet IP open protocol.
   B. The BAS shall be interfaced to allow remote monitoring of specified controller outputs and inputs and shall be capable of resetting room temperature set point.
   C. The BAS interface must be installed and fully operational before the control system will be accepted.
   D. The airflow control device shall have provisions to connect a notebook PC commissioning tool and every node on the network shall be accessible from any point in the system.

2.11 CONDUIT AND WIRING SYSTEM
   A. Cabling for these systems shall be either fiber optic, 24 AWG shielded twisted copper pair, or a mix of both. The Owner will consider exceptions to this requirement only if the laboratory tracking systems and constant volume valve manufacturer provides technical documentation, demonstrating that:
      1. This system will not function unless a different type of cable is used.
      2. The National Electrical Code requires cables to be shielded.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Provide a Project Manager, who shall, as a part of the Project Manager’s duties, be responsible for the following activities:
      1. Coordination between the Contractor and all other trades, Owner, local authorities and the Architect/Engineer.
      2. Scheduling of manpower, material delivery, equipment installation, and checkout.
      3. Maintenance of construction records such as Project scheduling, manpower planning, and AutoCAD Drawings for Project coordination and Record Drawings.
   B. Calibration:
      1. Each Venturi airflow control valve shall be factory calibrated to the Project specific airflows as detailed on the Contract Documents. Valve shall be electronically calibrated / characterized at the factory by certified NIST traceable air stations. The valve’s
characterization shall be determined at eight (8) unique airflows including a test of the valve's pressure independence at three (3) different static pressures. A total of nineteen (19) airflow checks shall be performed and recorded for each air valve. All information shall be stored on a flash drive for future retrieval or for hard copy printout.

2. Field adjustment shall not be required other than minor changes as required by the TAB Firm. Accuracies and performance shall be guaranteed as specified irrespective of field conditions.

3. Air shall be maintained plus or minus 5 percent of the design air quantity setting (subject to valve maximum and minimum CFM limits) over an inlet static pressure rate of 0.6 to 3.0 inches static pressure.

3.2 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer’s published recommendations.

C. Coordinate hood installation provisions with the project hood supplier.

D. Coordinate the placement and installation of the sash position sensor with Project hood supplier or manufacturer.

3.3 SYSTEM START-UP AND TRAINING

A. System start up shall be provided by a factory authorized representative of the laboratory airflow control system manufacturer. Start up shall include calibrating the fume hood monitor and any combination sash sensing equipment as required. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, make up, general exhaust, or return).

B. The balancing contractor shall be responsible for final verification and reporting of all airflows. All balancing shall be coordinated with the commissioning efforts of the BAS system.

C. The laboratory airflow control system supplier shall furnish owner training, by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves, and general troubleshooting procedures.

D. Operation and Maintenance manuals, including as-built wiring diagrams and component lists shall be provided for each training attendee.

END OF SECTION
PART 1 - GENERAL

1.1 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. Air-vent piping.

B. Related Specifications
   1. Section 23 0523, General Duty Valves for HVAC Piping, for valves
   2. Section 23 2116, Hydronic Specialties, for hydronic specialties.

1.2 SUBMITTALS

A. Product Data: For each type of the following:
   1. Pipe
   2. Fittings and accessories

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. Cleaning/Flushing Plan: This must be submitted and approved prior to any piping being installed. Plan, including all steps to be taken to ensure the piping installation will be cleaned properly prior to: service, circulation through equipment, or connection to another system. This shall include, but not be limited to:
   1. A step by step explication of the process.
   2. Drawing(s) indicating flow (gpm) values required to meet the minimum velocity in each pipe.
   3. Drawing(s) indicating the phase(s) in which the system will be cleaned as required to ensure the minimum velocity will be maintained in each section of piping.
   4. Drawing(s) indicating locations of the required temporary connections, valves, strainers, and bypasses.
   5. Cutsheet of the temporary pump to be used during flushing.
   6. Water treatment and pipe cleaning chemicals.

D. Field quality-control test reports.

E. Submit certification of welder’s qualifications to perform the required welding operations.

F. Operation and maintenance data.
1.3 QUALITY ASSURANCE

A. 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 1.

B. Provide domestic manufactured piping and fittings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect piping, valves, fittings, etc. before installation in accordance with manufacturer's written instructions.

B. Piping shall be shipped from the factory with capped ends and stored on supports off the ground with ends covered at all times to prevent nesting of insects, birds, and other animals. Any pipe found to be without end-caps or not raised off of the ground should be cleaned by the contractor prior to installation.

C. Protect piping from accumulation of dirt and debris in and around piping/components.

1.5 OPERATION AND MAINTENANCE DATA

A. Operation and maintenance manuals shall include the following information:
   1. The approved submittal with all approved items present (not a partial resubmittal)
   2. Chemicals used in cleaning, flushing, inhibiting, and final water treatment.
   3. Water quality test reports from the cleaning process.

PART 2 - PRODUCTS

2.1 STEEL PIPING AND FITTINGS

A. 2 inches and less in diameter. ASTM A 53, Grade B, standard-weight seamless black steel pipe with standard-weight malleable iron threaded fittings, satisfying ASTM B16.3 and ASTM A 197

B. 2-1/2 inches to 10 inches in diameter. ASTM A 53, Grade B, standard-weight seamless black steel pipe with standard-weight seamless steel welded fittings, satisfying ASTM A 234, Grade WPA or WPB, ANSI B16.9.

2.2 COPPER PIPING AND FITTINGS

A. ASTM B88, hard drawn Type L seamless copper tube with wrought copper fittings, ASTM B16.22.
2.3 JOINTS

A. Screwed (Steel Piping, 2” and smaller):
2. Apply suitable joint compound, such as Teflon tape to the male threads only.
3. Ream pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. Dissimilar Metals: Make joints between copper and steel pipe and equipment along with steel pipe and ductile iron pipe using insulating unions.
1. Provide insulating unions as manufactured by Crane, EPCO Sales, Inc. or approved equivalent.

C. Solder Joints (Copper Piping):
1. Prior to making joints, cut pipe square and ream to full diameter. Clean exterior of pipe and socket. Apply thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
3. Utilize lead free solder. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping.

D. Welded (Steel Piping, 2-1/2” and larger):
1. Make welded joints as recommended by the standards of the American Welding Society.
2. Ensure complete penetration of deposited metal with base metal.
3. Provide filler metal suitable for use with base metal.
4. Keep inside of fittings free from globules of weld metal.
5. Do not use mitered joints.
6. Use standard weld elbow fittings for changes of direction or cut a standard elbow for odd angles.

E. Flanged:
1. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64 inch per foot inclination of the flange face from true alignment.
2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
3. Install proper gaskets, suitable for intended service and factory cut to proper dimensions. Red rubber gaskets are not acceptable. Garlock gaskets or EPDM shall be used. Apply non-stick clean surface lubricant coating to both sides of gaskets.
4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use galvanized steel nuts and bolts underground, coated with two coats of coal tar enamel. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets. Use anti-seize compound on all bolts above and below grade. Bolt threads not to protrude more than 2 threads past nut.
5. Use carbon steel flanges conforming to ANSI B16.5 with materials conforming to ASTM A 105, Grade II or ASTM A 108, Grade II. Use welding neck type flanges at all fittings and on all pipe.
6. Flanges for ductile iron pipe are specified in sections using that pipe.
7. Keep flange covers on equipment and shop-fabricated piping until ready to install in system.
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. Gasket Material: Thickness, material, and type suitable for fluid to be handled, and working temperatures and pressures.

2.5 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Unions (for connecting to equipment where OEM connection provided is plastic):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. IPEX Inc.
      c. KBi.
      d. NIBCO INC.
   2. MSS SP-107, CPVC union. Include brass or copper end, Schedule 80 solvent-cement-joint end, rubber gasket, and threaded union.

2.6 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:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Central Plastics Company.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
   2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180°F.
D. Dielectric Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Calpico, Inc.
   b. Lochinvar Corporation.
2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225°F.

2.7 UNIONS
A. Use 150-pound standard (300-pound WOG) malleable iron, ground joint unions with bronze seat. Provide flanged union joints on piping larger than 2-1/2 inches.

2.8 BRANCH CONNECTIONS
A. For Pipe 2 inches and smaller, use threaded fittings for steel pipe. For threaded piping, use straight size of reducing tee.
B. For 2-1/2 Inches through 20 inches. For welded piping, when branch size is the same as and one size smaller than header size, use welding tee. Use Weldolet when branch is two or more sizes smaller than header. For threaded branch connections, use thread-o-let welded to header.

2.9 GASKETS
A. Provide gaskets between flanges of all flanged joints. Inside diameter of gaskets shall conform to nominal pipe size. Gaskets shall be ring type between raised face flanges and full face between flat face flanges with punched bolt holes and pipe opening.
B. Gaskets shall be cut from 1/8 inch thick non-metallic, non-asbestos gasket material suitable for operating temperatures from -150°F to +750°F. Garlock or equal. For pipe smaller than 6 inches, use 1/16 inch thick gasket.

2.10 FLOOR AND CEILING PLATES
A. Provide chrome-plated floor and ceiling plates around pipes exposed to view and passing through walls, floors, partitions, or ceilings in finished areas. Size plates to fit pipe or insulation and securely lock in place.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS
A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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 branch connections to mains using tee fittings in main pipe, with the branch connected to the top of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

N. Install valves according to the appropriate section.

O. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

P. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

Q. 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.

R. Identify piping as specified in the above referenced specification section.

S. Support piping adequately to maintain line and grade, with due provision for expansion and contraction.
T. Use only long radius elbows on steel and copper piping unless a short radius elbow is specifically shown on the drawings.

U. Provide dielectric union or flange at connections of dissimilar metals, including equipment connections.

3.2 WELDING

A. Weld and fabricate piping in accordance with ANSI Standard B31.9, latest edition, Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.

B. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale and other foreign matter from inside piping before tying in sections, fittings, valves or equipment.

3.3 OFFSETS AND FITTINGS

A. Because of the small scale of drawings, the indication of all offsets and fittings is not possible. Carefully investigate the structural and finish conditions affecting the work and take such steps as may be required to meet such conditions.

B. Install all piping close to walls, ceilings and columns so piping will occupy the minimum space. Provide proper space for covering and removal of pipe, special clearances, and for offsets and fittings.

C. Install piping as to not obstruct any equipment or architectural access doors.

3.4 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections at each floor and at branch takeoffs serving equipment, and at other locations as indicated and required for isolation of piping or equipment.

3.5 DRAIN VALVES AND VENTS

A. Install drain valves at all low points and at base of all risers of water piping systems so that these systems can be entirely drained.
B. Install 2 inch drain for 2-inch pipes and larger.
C. Install a line size drain valve for pipes smaller than 2 inches.
D. Provide hose adapter and cap on all drain lines.
E. Provide automatic vents with isolation valves or manual vents at locations as indicated on Drawings and all high points in piping systems.

3.6 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.
E. 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.
F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

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 ports for pressure gages and thermometers at coil inlet and outlet connections according to the above referenced specification section. Refer to drawings for additional requirements.

3.8 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS
A. Provide service connections to items of equipment furnished by others:
   1. Detailed shop drawings of equipment shall be furnished indicated the exact number and location of rough-in points.
2. Such final shop drawings may indicate adjustments in total number and exact location of rough-in points, and in equipment dimensions.
3. Making adjustments to field conditions is considered a part of the work required.

B. Roughing-In:
1. When roughing-in, extend service piping to various items of equipment.
2. Temporarily terminate at proper points as indicated on detailed equipment shop drawings or as directed.
3. Do not use contract drawings accompanying specifications for rough-in locations but for pipe sizing and general routing.

C. Stop Valves:
1. Provide stop valves for each service at rough-in locations, except for drains.
2. Stop valve locations are subject to approval, and in all cases must be accessible from the same room in which the furniture or equipment is located.

3.9 CLEANING OF PIPING SYSTEMS

A. Cleaning of piping system must be performed by the mechanical contractor. Cleaning chemicals, procedure, water testing, reporting, and consultation must be provided by a qualified water treatment company specializing in this type of work. Qualified water treatment vendor will have the following features.
1. Operating in the business of industrial water treatment for minimum 5 years.
2. Certified to the ISO 9000 quality standard.
3. Manufacture and deliver their own products.
4. Provide technical specialist(s) for onsite water testing, reporting, and consultation.
5. Have the ability to perform offsite analytical laboratory work and reporting if necessary.

B. Acceptable vendors should include, but not be limited to the following companies:
2. GE Water & Process Technologies
3. Nalco Company

C. Minimum velocity of 10 feet per second for steel piping must be maintained in the pipes during flushing period.
1. Do not use building pumps for circulating water.
2. Provide temporary pumps as required to achieve minimum velocities.
3. Remove flow meters from building piping during flushing operation.
4. Provide means (instrumentation) during flushing period to prove to the Owner that the minimum velocities are maintained in the pipes.
5. For copper piping, maintain the flushing velocity between 3 (min) and 5 (max) feet per second. Limit temperature of water inside piping to a maximum 140°F.

D. Submit a detailed plan for the Engineer’s and Owner's review and approval describing in full detail the individual steps associated with this process before any piping is installed.
1. Refer to Submittal section above for further requirements.

E. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the systems in service. Provide temporary connections and valves as required for cleaning, purging and circulating. Provide temporary relief valves to protect the piping system if recommended by the pipe cleaning subcontractor.
F. Install temporary strainers in front of pumps, tanks, water still, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blowoff valve.

G. Provide bypasses at the following equipment as close as feasibly possible to the equipment (no more than 10 feet total of piping at each piece of equipment) and isolate equipment as required (temporary blind flanges or similar):
1. Hydronic coils

H. Chemicals shall remove mill scale, oil, and greases as well as passivate surfaces with a protective oxide film. NOTE: All residuals of the cleaning and passivating chemicals must be totally blown-down prior to system startup.
1. Alkaline cleaner/penetrant/dispersant chemical. This product must be in liquid form and capable of removing mill scale, oils, greases, debris, and byproducts of construction. It shall be fed at the vendor’s recommended dosage rate based on the volumes of the systems treated.
2. Passivating chemical. This product must be in liquid poly-phosphate form and capable of laying down a protective oxide film on metal surfaces after treatment with the cleaning chemical. It shall be fed at the vendor’s recommended dosage rate based on the volumes of the systems treated.
3. Antifoam chemical. This product must be in liquid form and capable of controlling or eliminating foam in water systems.

I. Chemical for inhibiting and controlling corrosion and deposits must be added immediately after the chemical cleaning and passivating procedure.
1. Closed loop corrosion inhibitor chemical. This product must be in liquid form and impart the following active ingredients at the following dosages when fed in the Heating Hot Water Loop water: 1) nitrite (as NO2) = 800-1200 ppm, 2) borate = 400-600 ppm, 3) azole = 40-80 ppm.

J. Circulate chemical cleaner and passivator in closed loop water piping systems to remove mill scale, grease, oil, and silt.
1. Flush and drain loops to remove debris prior to using chemicals.
2. Fill loops and add chemical cleaner and passivator at the dosage rates recommended by the water treatment vendor based on system volume.
3. Add antifoam at the dosage rates recommended by the water treatment vendor.
4. Circulate water for 24-72 hours.
5. Drain and flush system.
6. Dispose of circulated water with chemical residuals as per local code requirements.
7. Refill and immediately charge with the proper corrosion inhibitor – based on the type of piping system – to the recommended level.
8. Match chemicals presently used in other systems used by Owner if possible.
9. Submit all chemicals to Owner and Engineer prior to cleaning for approval.
10. Match chemicals presently used in other systems used by Owner.
11. Provide report comparing make-up water quality to the water circulated in the pipe after cleaning chemicals are removed. Report shall include the following at a minimum:
   a. Conductivity
   b. Ph
   c. phosphate
   d. Iron

K. Special requirements, if any, are specified in the appropriate Sections for each type of piping.
L. After systems have been flushed and cleaned; as required by specifications, provide written certification from the cleaning contractor that the systems are clean and ready for use. This shall include the water quality report comparing the make-up water to the water circulated in the piping after removal of chemicals to verify pipe condition.

3.10 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, minimum 150 psig. 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.
### 3.11 PIPING APPLICATION SCHEDULE

A. Provide piping and fittings meeting the requirements of Part 2 as identified in the table below:

<table>
<thead>
<tr>
<th>Service</th>
<th>Pipe Sizes</th>
<th>Pipe Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Hot Water Piping</td>
<td>2&quot; and smaller</td>
<td>Copper</td>
</tr>
<tr>
<td>Heating Hot Water Piping</td>
<td>2-1/2&quot; and larger</td>
<td>Steel</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Perform Work required to provide and install ductwork, flexible duct, hangers, supports, sleeves, flashings, and all necessary accessories as indicated in the Contract Documents. Provide any supplementary items necessary for proper installation.

B. Section Includes:
   1. Rectangular ducts and fittings.
   2. Round ducts and fittings.
   3. Fume hood ductwork.
   4. Sheet metal materials.
   5. Sealants and gaskets.
   6. Hangers and supports.

C. Related Sections:
   1. Division 09 Section, Painting, for interior painting of metal ductwork exposed to view through grilles, registers, and other openings.
   2. Section 23 0593, Testing, Adjusting, and Balancing for HVAC, for testing, adjusting, and balancing requirements for metal ducts.
   3. Section 23 0713, External Ductwork Insulation.
   4. Section 23 3300, Ductwork Accessories, for dampers, spin-in fittings, flexible duct connections.
   5. Section 23 3713, Air Devices.

1.2 DEFINITIONS

A. Low Pressure: Up to 2 inches w.g. positive or negative static pressure and velocity equal to 1500 fpm. Constructed and tested for +2 inches W.G.

B. Medium Pressure: Over 2 inches w.g. through 6 inches w.g. positive or negative static pressure and velocity greater than 1500 fpm. All medium pressure ductwork shall be constructed and tested for +6 inches w.g.

C. High Pressure: Over than 6 inches w.g. positive static pressure and velocity greater than 2500 fpm.

D. Duct Size. The supply, return and exhaust duct sizes shown on drawings are clear inside sheet metal dimensions. Include proper allowances for acoustical lining, where indicated in plans or specifications. For acoustical return air boots, refer to additional information on detail.
1.3 GUARANTEE

A. Guarantee all ductwork for 1 year from the date of final acceptance. The guarantee will cover workmanship, noise, chatter, whistling or vibration. Ductwork shall be free from pulsation under all conditions of operation.

1.4 CONTRACTOR COORDINATION

A. Erect all ducts in the general locations shown on the drawing(s), but conform to all structural and finish conditions of the building. Before fabricating any ductwork, Contractor to check the physical conditions at the job site and make all necessary changes in cross sections, offsets and similar items, whether they are specifically indicated on drawing(s) or not. Do not obstruct the induced air plenum opening at VAV boxes and service access spaces for VAV boxes and other equipment.

B. 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.

1.5 STANDARDS AND CODES

A. Except as otherwise indicated, sheet metal ductwork material, fabrication and installation shall comply with second edition of SMACNA HVAC Construction Standards Metal and Flexible, except where indicated otherwise. All air distribution devices (such as dampers) included in this Section shall comply with the second edition of SMACNA HVAC Construction Standards Metal and Flexible.

B. In addition, construct ductwork and all air distribution devices to the following:
   1. IMC International Mechanical Code
   2. NFPA 90A  Installation of Air Conditioning and Ventilating Systems.
   3. NFPA 90B  Installation of Warm Air Heating and Air Conditioning Systems
   4. NFPA 45 – Laboratory Ventilating Systems and Hood Requirements
   5. SMACNA Round Industrial Duct Construction Standards
   6. SMACNA The Managers’ Guide for Welding

1.6 SUBMITTALS

A. Product Data
   1. Submit product data for each product. Refer to Section 23 0010.
   2. Provide acoustical data on insulated flexible ductwork as indicated in Part 2.

B. Delegated-Design Submittal. Include the following for each system furnished on the project.
   1. System name and type
   2. Duct system design pressure.
   4. Reinforcement details and spacing.
   5. Seam and joint construction and sealing.
6. Fittings, construction and details.
7. Hangers and supports, including materials, fabrication, methods for duct and building attachment.

C. Ductwork shop drawings. Provide CAD-generated shop drawings of building ductwork drawn at a minimum scale of \( \frac{1}{4} \) inch per foot. Include the following as a minimum:
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory and shop fabricated duct and fittings.
3. Duct layout indicating sizes, configuration and pressure classes.
4. Elevations of top and bottom of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Reinforcement and spacing.
7. Penetrations through fire-rated and other partitions.
8. Equipment installation based on equipment being used on Project.
9. Duct accessories, including access doors and panels, fire dampers and smoke dampers.

D. Welding certificates. For duct welders including procedures and standards of acceptance

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Spiral Ductwork: Gowco, McCorvey, United McGill, Lindab (supply duct only).

B. Sheet Metal Products: McCorvey Sheet Metal Works, Gowco, United McGill, Flexmaster

C. Insulated Flexible Duct: Pepertree Air Solutions, Thermaflex, Flexmaster.

2.2 APPLICATION

A. Ductwork shall be constructed in accordance with the following as a minimum. Refer to drawings for any deviations from this table.

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>MATERIAL</th>
<th>MINIMUM PRESSURE CLASSIFICATION (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply Systems:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All ductwork downstream of terminal boxes</td>
<td>Galvanized Steel</td>
<td>Low Pressure</td>
</tr>
<tr>
<td>Supply ductwork downstream of single zone VAV AHUs(2)</td>
<td>Galvanized Steel</td>
<td>Medium Pressure</td>
</tr>
<tr>
<td>Inlet connection to terminal box</td>
<td>Flexible Duct</td>
<td>As Specified</td>
</tr>
<tr>
<td>Connection to Air Device</td>
<td>Flexible Duct</td>
<td>As Specified</td>
</tr>
<tr>
<td><strong>Return Systems:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return air boot/transfer duct</td>
<td>Galvanized Steel</td>
<td>Low Pressure</td>
</tr>
<tr>
<td><strong>Laboratory Exhaust Systems</strong>(3):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General lab exhaust - air device to General Exhaust valve</td>
<td>Galvanized Steel</td>
<td>Low Pressure(6)</td>
</tr>
</tbody>
</table>
**SYSTEM** | **MATERIAL** | **MINIMUM PRESSURE CLASSIFICATION**
---|---|---
General lab exhaust – General Exhaust valve to main | 316L Stainless Steel | Medium Pressure
Lab exhaust – Hood to Lab Exhaust valve | 316L Stainless Steel | Medium Pressure
Lab exhaust – Lab Exhaust valve to main | 316L Stainless Steel | Medium Pressure

B. Notes to Table:
1. Positive pressure unless noted otherwise in Table.
2. From air handling unit (AHU) to terminal boxes.
3. From pretreatment AHU to AHU.
4. Runout from air device to return/exhaust air trunk duct
5. Negative pressure SMACNA table.
6. Verify minimum pressure classification per NFPA 96 requirements.
7. Applies to exhaust system for general laboratory exhaust, fume hoods, snorkels, and biosafety cabinets. Refer to Drawings for construction of any additional exhaust systems.

### 2.3 DUCT MATERIAL AND CONSTRUCTION

A. General. Noncombustible or conforming to requirements for Class I air duct materials or UL 181. All ductwork indicated on the Drawings, specified or required for the air conditioning and ventilating systems shall be of materials as hereinafter specified unless indicated otherwise on Drawings. All air distribution ductwork shall be fabricated, erected, supported, etc., in accordance with all applicable standards of SMACNA where such standards do not conflict with NFPA 90A and where class of construction equals or exceeds that noted herein

B. Galvanized Steel Ducts. Constructed of G-60 coated galvanized steel meeting requirements of ASTM A 653 or ASTM A 527. Stencil coils of sheet steel throughout on 10 foot centers with gauge and manufacturer's name. All materials associated with the duct system shall be galvanized steel including stiffeners, fasteners, etc.

C. Stainless Steel Ducts. 316L as indicated in application schedule. For round ductwork, butt-welded (solid welded) longitudinal seam only. Spiral lockseam and Spiral lockseam with standing rib is not acceptable.

D. Fasteners. Rivets, bolts or sheet metal screws.

E. Sealant.
1. Sealant shall be water based, latex UL 181B-M sealant with flame spread of 0 and smoke developed of 0. Sealants shall be similar to Foster 32-19, Childers CP-146, Hard Cast Iron Grip 601, Ductmate Pro Seal or Design Polymerics DP 1010.
2. Scrim tape shall be fiberglass open weave tape, 3 inches wide, with maximum 20/10 thread count.

F. Hangers and Supports.
1. Support ductwork with continuously threaded hanger rods of galvanized steel or 20 gauge straps as indicated in these specifications.
2.4  RECTANGULAR DUCTS AND FITTINGS GENERAL REQUIREMENTS

A. General Fabrication Requirements: Comply with SMACNA based on indicated static-pressure class unless otherwise indicated. In no case shall the ductwork be less than 26 gauge for low pressure ductwork, 24 gauge for medium pressure ductwork.

B. Transverse Joints: Select joint types and fabricate according to SMACNA Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA. Snaplock longitudinal seams (L2) are not acceptable.

D. Fittings:
  1. Select types and fabricate according to SMACNA Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
  2. Construct bends and elbows per SMACNA Figure 2-2, "Rectangular Elbows", Type RE1 with radius of not less than 1-1/2 times width of duct on centerline. Where not possible or where indicated on construction documents, construct Type RE2 rectangular elbows with welded-in-place double wall airfoil turning vanes (whether specifically shown on drawings or not), or short radius type RE1 radius elbows.
  3. Construct tees per SMACNA Figure 2-5, "Divided Flow Branches", Type 2, Type 3, Type 4A or 4.
  4. Construct branch connections per SMACNA Figure 2-6, "Branch Connection". Use 45 degree entry, 45 degree lead in, conical or bellmouth connections only.
  5. Unless indicated on construction document details, transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence. Divergence upstream of equipment shall not exceed 30 degrees. Convergence downstream of equipment shall not exceed 45 degrees.
  6. Bullhead tees are not permitted.

2.5  ROUND AND OVAL DUCTS AND FITTINGS GENERAL REQUIREMENTS

A. General Fabrication Requirements: Comply with SMACNA Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated. In no case shall the ductwork be less than 26 gauge.

B. Transverse Joints: Select joint types and fabricate according to SMACNA Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA. Use flanged joints for ducts larger than 48 inches in diameter.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA 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. Utilize spiral seam or butt weld seams only. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Fittings:
1. Fittings shall have a wall thickness not less than that specified for longitudinal-seam straight duct or 26 gauge, whichever is more stringent.

2. Tees and Laterals: Select types and fabricate according to SMACNA 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. Utilize 90 degree tee with oval to round tap, 45 degree lateral tap, or conical fitting only. Wye fittings may be utilized where specifically indicated on drawings and details.

3. Elbows: Construct elbows with radius of not less than 1-1/2 times width of duct on centerline. Provide minimum 5 gore elbows on all 90 deg elbows, 3 gore elbows on 45 degree elbows. Continuously welded stamped long radius elbows may be utilized on ductwork up to and including 12-inches in diameter.

4. Bullhead tees are not permitted.

2.6 INSULATED FLEXIBLE DUCTWORK

A. Use for connection to diffusers, grilles and terminal boxes as indicated in specifications and details.

B. Construct the inner liner of coated steel helix and a PE or CPE liner substantially bonded together to prevent the duct from collapsing or kinking in short radius bends. Provide fiberglass insulation providing minimum R-4.2 thermal conductance and 3 pound minimum density around inner jacket consisting of fiberglass reinforcement and aluminum foil vapor barrier outer jacket. Use duct rated at minimum working pressure of 10 inches of water positive and 1 inches of water maximum negative pressure (4-12 in I.D.), and 6 inches of water positive and 1/2 inch of water maximum negative pressure (14- 16 I.D.). Provide duct listed by U.L. at flame spread rate of not over 25 and smoke developed rate of not over 50, and complying with NFPA Standard 90A and 90B. The entire assembly shall be listed by Underwriters Laboratories under U.L. Standard 181 as a Class I flexible air duct. Supplier shall submit laboratory test results indicating acoustical performance comparable to that of "Flexmaster Type 1M-Insulated".

2.7 STAINLESS STEEL DUCTWORK (LAB EXHAUST)

A. Applies to stainless steel ductwork indicated in specification application table for Laboratory Exhaust Systems.

B. Provide exhaust ductwork of minimum gauges:

<table>
<thead>
<tr>
<th>DUCT SIZE</th>
<th>GAUGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-inch diameter or less</td>
<td>18</td>
</tr>
<tr>
<td>30-inch to 60-inch diameter</td>
<td>16</td>
</tr>
<tr>
<td>61-inch diameter or greater</td>
<td>14</td>
</tr>
<tr>
<td>Greater than 60 x 42 (rectangular or oval)</td>
<td>Comply with SMACNA</td>
</tr>
</tbody>
</table>

C. ALL LAB EXHAUST DUCTWORK SHALL HAVE LONGITUDINAL BUTT ("SOLID") WELD SEAMS WITH BUTT WELD JOINTS. Butt-weld all joints and fittings using Gas Tungsten Arc Welding ("TIG"). Welding procedures shall meet the requirements of SMACNA’s The Managers’ Guide for Welding. Welds on exposed ductwork inside the building shall be ground and polished. Duct sealant shall not be used to seal ductwork.
D. Provide required transitions from duct to equipment and make equipment connections as indicated on details.

E. Fittings:
   1. Refer to Round and Oval Ducts and Fittings General Requirements in this specification. Transverse and longitudinal seams shall be butt welded joints.
   2. Refer to drawings for additional information.

F. Submit upon request by owner or A/E, certification of welder's qualifications to perform the required welding operations and all project WPS for TIG welding sheet metal. All welder certifications shall be maximum 2 years prior to project notice to proceed date.

2.8 INTERNAL ACOUSTIC DUCT LINING

A. Internal insulation with JohnsManville Permacote Linacoustic standard fiberglass duct liner with factory-applied edge coating. Insulation shall have a composite, abrasion resistant airstream surface with EPA-registered, anti-microbial coating that will not support microbial growth.

B. Duct Lining used on the project must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B.

C. Provide insulation thicknesses as follows:
   1. Provide 1/2 inch insulation on all return air transfer ductwork as shown on detail.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Construction Standards. Use construction methods which follow the requirements outlined SMACNA publications, as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in these specifications or accompanying drawings.

B. Reinforcement. Reinforce ducts having one side equal to 25 inches or more in accordance with recommended construction practice of SMACNA.

C. Plenum Construction. Construct plenum chambers of not less than No. 20 U.S. gauge metal reinforced with galvanized structural angles.

D. Cross Breaking or Beading. Cross break or bead sheet metal for rigidity, except ducts which are 12 inches or less in the longest dimension.

E. Wall Penetrations.
   1. Provide 24 gauge sheet metal sleeves for insulated and non-insulated ducts penetrating gyp board walls. Seal openings between ducts and sleeves with fireproofing sealants.
F. Interior Painting. Interior painting of metal ductwork exposed to view through grilles, registers, and other openings is specified in the Section on painting. Do not install grilles, registers, or similar items until painting is complete.

G. Ductwork Openings. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

H. Ductwork Location. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities, including access to electrical and control panels.

I. Instrument Test Hole Fitting. Provide Duro Dyne Model TH-1 instrument test ports with heavy-duty zinc-plated heavy-gauge cap, instant-release wing nut, neoprene expansion plug, flat neoprene mounting bracket and mounting holes. Provide fittings to air balance contractor.

J. Provide transitions at equipment and air device connections as per SMACNA standards. Where equipment requires an oval inlet and a round flex duct is routed to the equipment, provide insulated round to oval transition.

K. Install duct mounted hot water coils, provided in other specification sections, if required.

L. Refer to mechanical details for information on terminal box connections, diffuser connections, fume hood connections, lab-trac equipment, etc.

3.2 SEAM AND JOINT SEALING

A. All duct systems (except welded exhaust ductwork and double wall flue) shall be sealed. Duct shall be thoroughly cleaned prior to application of sealant. All transverse joints, longitudinal seams and duct wall penetrations shall be sealed. All ductwork shall be sealed as per seal Class A of SMACNA Standards irrespective of the duct pressure classifications.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports." Unless indicated otherwise in specifications.

B. 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. Do not use wire to support ductwork.

C. Horizontal Ducts Up to 40 Inches. Support horizontal ducts up to and including 40 inches in their greater dimension by means of No. 20 U.S. gauge band iron hangers attached to the ducts by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Use clamps to fasten hangers to reinforcing on sealed ducts.
D. Horizontal Ducts Larger Than 40 Inches. Support horizontal ducts larger than 40 inches in their greatest dimension by means of hanger rods bolted to angle iron (or equivalent unistrut) trapeze hangers. Place supports on at least 8'-0" centers according to the following:

<table>
<thead>
<tr>
<th>Angle Length</th>
<th>Angle</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'-0&quot;</td>
<td>1-1/2&quot; x 1-1/2&quot; x 1/8&quot;</td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>1-1/2&quot; x 1-1/2&quot; x 1/8&quot;</td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>2&quot; x 2&quot; x 1/8&quot;</td>
<td>5/16&quot;</td>
</tr>
<tr>
<td>10'-0&quot;</td>
<td>3&quot; x 3&quot; x 1/8&quot;</td>
<td>3/8&quot;</td>
</tr>
</tbody>
</table>

The trapeze is to be placed on the exterior of non-compressible insulation between hanger and ductwork.

E. Vertical Ducts. Support ducts to ensure rigid installation. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Fig. 4-7, Fig 4-8, Fig 4-9 "Riser Supports – From Floor". Support vertical ducts where they pass through the floor lines with 1-1/2 inches x 1-1/2 inches x 1/4 inch angles for ducts up to 60 inches. Above 60 inches, the angles must be increased in strength and sized on an individual basis considering space requirements. Support vertical duct drops more than 6 feet in length with angle iron frames attached to ducts.

F. Refer to drawings for additional hanger details and requirements. Note that not all hangers are shown on the drawings in the BIM model. The Contractor shall coordinate all hangers with the structure and other trades.

3.4 FLEXIBLE DUCTWORK

A. Low Pressure Flexible Ductwork
   1. Do not exceed 5 feet in length with any flexible duct.
   2. Flexible duct shall be limited to a maximum of a single 90 degree change in direction between the duct and the neck of the air device. This does not include the final turn into the neck of the air device.
   3. Support ductwork independently of lights, ceiling and piping. Provide harness at connection to ceiling diffuser as indicated on details.
   4. Provide two nylon panduits or stainless steel work clamps on inner core and seal connection with duct sealant. The insulation and outer jacket shall be slipped over inner core connection to point where insulation abuts insulation on duct or terminal box. The insulation connections shall be sealed by embedding scrim tap and sealant to form a vapor barrier.

B. Medium Pressure Flexible Ductwork
   1. Refer to details for maximum length of flexible ductwork upstream of terminal box.
   2. Do not use flexible ductwork for changes in direction of airflow.
   3. Provide two stainless steel work clamps on inner core and seal connection with duct sealant. The insulation and outer jacket shall be slipped over inner core connection to point where insulation abuts insulation on duct or terminal box. The insulation connections shall be sealed by embedding scrim tap and sealant to form a vapor barrier.
3.5 LABORATORY EXHAUST DUCTWORK

A. Butt-weld all joints and fittings using Gas Tungsten Arc Welding ("TIG") as indicated in Part 2. Welding procedures shall meet the requirements of SMACNA's The Managers' Guide for Welding. The welder shall be experienced and qualified with TIG welding. Prior to welding joints are fittings, the ductwork shall be free of rust, oil, paint or other foreign materials.

B. Install ducts with an upward grade in the direction of flow. Make the grade a minimum of 1/8 inch per foot. Low places in the duct that can collect moisture will not be allowed. Use eccentric reducers, with the flat on bottom, in ductwork to maintain slope.

C. All welds shall be cleaned with uncontaminated stainless steel wire brush prior to inspection. Welds shall be visually inspected and meet the requirements of AWS D9.1 and SMACNA's The Managers' Guide for Welding.

3.6 DUCT LINING

A. Fiberglass acoustical lining is not permitted to be installed on this project except as indicated in this specification or specifically shown on drawings.

B. Install per manufacturer's recommendations. Keep internal lining clean during construction by keeping ends of ductwork sealed during storage and construction.

3.7 TESTS

A. Allowable Leakage. Test ductwork for leaks in accordance with SMACNA testing procedures before concealing or insulating as indicated below. Arrange for the Owner's Representative to witness the test.

1. Low pressure ductwork. Test low pressure ductwork at +2 inches W.G. Maximum allowable leakage (Lmax) per 100 ft\(^2\) of ductwork shall be equal to C\(_L\) \(\times P^{0.65}\), where C\(_L\) = 6 for rectangular ducts and round flexible ducts, C\(_L\) = 3 for round/flat oval ducts, and P = 2" for low pressure ducts.

2. Medium pressure ductwork. Test medium pressure ductwork at +6 inches W.G. Maximum allowable leakage (Lmax) per 100 ft\(^2\) of ductwork shall be equal to C\(_L\) \(\times P^{0.65}\), where C\(_L\) = 4 for rectangular ducts and round flexible ducts, C\(_L\) = 3 for round/flat oval ducts, and P = 6" for medium pressure ducts.

3. Lab exhaust ductwork. Test laboratory exhaust ductwork at +6 inches w.g. Maximum allowable leakage is 1/2% of the total system air flow rate. Where partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

4. Test the following ductwork:
   a. Low pressure ductwork:
      1) All ductwork served by terminal boxes.
   b. Medium pressure ductwork:
      1) All ductwork served by individual air handling units.
      2) All ductwork served by exhaust fans.
   c. Other
      1) Do not test Double Wall Flue Piping or Dryer Exhaust Ductwork.

B. Equipment. Provide equipment necessary for performing tests, including rotary blower, orifice section and U-tube gauge board complete with cocks and rubber tubing.
3.8 CLEANING

A. Protect all ductwork and equipment from dirt during storage, installation and prior to grille, diffuser installation with protective covering at each end. Ductwork exposed to dirt and dust due to inadequate protection will have to be removed, cleaned and reinstalled.

B. Do not operate any air handling units or fan coil units during construction without filters.

C. Provide temporary filters on return air ductwork during construction to protect ductwork from dust.

D. Provide temporary filters on exhaust grilles during construction to protect ductwork from dust.

E. Do not operate laboratory exhaust fans during any drywall operation to protect ductwork, hoods and laboratory control products.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire dampers.
   2. Volume control dampers.
   3. Duct access doors.
   4. Conical spin-in fittings and taps
   5. Duct accessory hardware.
   6. Flexible Connection
   7. Laboratory exhaust accessories

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Specification 23 3113, Ductwork

1.3 SUBMITTALS

A. Product Data: Submit product data for each product. Refer to Section 23 0010.

B. Fire and Combination Fire/Smoke Damper. Include manufacturer’s literature to include performance data and installation requirements. Include any wiring diagrams. Installation shall clearly indicate
   1. Proposed break-away connections used on the project.
   2. Clearance requirements between wall/floor and damper.
   3. Mounting/Retaining locations, size, gauge and fastener requirements.

C. Access Doors. Include type of material, installation guidelines, leakage rates and maximum pressure data.

D. Volume Control Dampers. Include type of material, installation guidelines, pressure drop and maximum pressure data.

E. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
   1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
      a. Special fittings.
c. Control damper installations.
d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors. Provide break-away duct/sleeve connection detail.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 23 0010.
   1. Include operation and maintenance information, including recommended testing requirements.

B. Fire dampers, smoke dampers and combination fire/smoke dampers.
   1. Include operation and maintenance information, including recommended testing requirements.
   2. Assign identification numbers (FD – Fire Damper, FSD – Fire/smoke Damper, SD – Smoke Damper) for each damper. Include table in O&M manual that indicates identification number, room location, duct system and size.

1.5 QUALITY ASSURANCE

A. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references
   2. AMCA 500-D, "Laboratory Method of Testing Dampers for Rating"
   4. SMACNA - HVAC Duct Construction Standards Metal and Flexible – Second Edition
   5. UL 555 – Standard for Fire Dampers.
   7. UL 555S – Standard for Smoke Dampers

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fire, Smoke and Fire/Smoke Dampers. Greenheck, Potterff, Ruskin.


C. Duct Access Doors. Ductmate, Flexmaster, Greenheck, Ruskin, United McGill.

D. Conical Spin-in Fittings. Flexmaster, Buckley

E. Volume Control Dampers. Flexmaster, Greenheck, Prefco, Ruskin.
2.2 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.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60.
   2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316L, 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.

2.3 FIRE DAMPERS (FD)

A. Quality Standards. Furnish and construct fire dampers according to NFPA 90A and UL 555 (Dynamic). Dampers must bear UL label and suitable for dynamic application. Dampers shall possess a 1-1/2 hour or 3 hour (as appropriate for the construction shown in the architectural Drawings) protection rating 165 degrees F fusible link.

B. Construct fire dampers such that damper frame material and curtain material are galvanized.

C. Use Curtain Type Fire Dampers for fire dampers where possible. Use Multiple Blade Fire Dampers for fire damper sizes that exceed manufacturer’s allowable Curtain Type Fire Damper sizes, or where velocities or pressures exceed Curtain Type Fire Dampers.

D. Curtain Type Fire Dampers (Type B)
   1. Damper shall be classified for dynamic closure to 2000 fpm and 4 inches w.g. static pressure.
   2. Damper shall have 5” frame constructed from minimum 20 gage galvanized steel.
   3. Blades shall be minimum 24 gage galvanized steel.
   4. Closure springs shall be Type 301 stainless steel, constant force or spring clip type.
   5. Provide Grille, Grille Access Type or Out of Wall Type of frame where indicated on drawings.

E. Multiple Blade Fire Damper
   1. Dampers shall be suitable for dynamic closure to 3000 fpm and 6 inches w.g. static pressure at 90’x64” for vertical installation and 60’x48” for horizontal installation.
   2. Damper shall have 5” frame constructed from minimum 16 gage galvanized steel channel and reinforced at the corners.
   3. Blades shall be 6” wide airfoil type and constructed from minimum 14 gage galvanized steel.
   4. Bearings shall be self-lubricating stainless steel sleeve, turning in extruded hole in frame.
   5. Blade seals shall be galvanized steel for flame seal to 1,900 degrees F and mechanically attached to blade edge.
   6. Linkage shall be concealed in frame.
   7. Provide ½-inch diameter plated steel hex shaped axle attached to blade.
8. Pressure drop shall be a maximum of 0.07 inches w.g. at 1,500 feet per minute through 24 x 24 inch damper.

2.4 VOLUME CONTROL DAMPERS

A. Provide volume dampers in round and rectangular ductwork where indicated on drawings.

B. General Fabrication Requirements:
   1. Comply with SMACNA Chapter 2, "Volume Dampers" unless more stringent requirements are indicated. Provide single blade dampers on round dampers and for rectangular dampers not exceeding 36-inches in width or 12-inches in height. Provide multiblade rectangular dampers for dampers exceeding 36-inches in width or 12-inches in height or where required due to velocity or pressure requirements.
   2. Refer to Specification 23 31 13 Ductwork for application table that defines Low and Medium Pressure ductwork.
   3. Provide a locking hand quadrant on all dampers. Mount quadrant regulators on stand-off mounting brackets, bases, or adapters on insulated ducts.
   4. Shop fabricated dampers are not acceptable.

C. Round Dampers.
   1. Low Pressure. Provide single blade damper with minimum 20 gauge galvanized steel frame, minimum 20 gauge galvanized steel blade, continuous 3/8" square plated steel axle mechanically attached to blade, and bronze or oilite bearings. Dampers shall be suitable for 1500 feet per minute velocity and a maximum pressure of 2"W.G. when closed, and a maximum pressure drop of 0.03"W.G at 1500 feet per minute through a 20-inch damper when tested in accordance with AMCA Fig. 5.3.
   2. Medium Pressure. Provide single blade damper with minimum 20 gauge galvanized steel frame, minimum 14 gauge (equivalent) galvanized steel blade, continuous 1/2" square plated steel axle mechanically attached to blade, and bronze or oilite bearings. Dampers shall be suitable for 3000 feet per minute velocity and a maximum pressure of 4"W.G. when closed, and a maximum pressure drop of 0.06"W.G at 2000 feet per minute through a 24-inch damper when tested in accordance with AMCA Fig. 5.3.

D. Rectangular Dampers.
   1. Low Pressure Single Blade Damper (Fans systems with less than 1"W.G. Static Pressure). Provide single blade damper with minimum 3-inch x 20 gauge galvanized steel frame, minimum 20 gauge galvanized steel blade on dampers up to 18-inches wide, 16 gauge on dampers over 18-inches wide. Provide a continuous 3/8" square plated steel axle mechanically attached to blade, and synthetic flanged sleeve type bearing. Dampers shall be suitable for 1500 feet per minute velocity and a maximum pressure of 1"W.G. when closed.
   2. Low Pressure Multi-Blade Damper. Provide opposed multi-blade damper with minimum 5-inch x 16 gauge galvanized steel frame, minimum 16 gauge triple V galvanized steel blade. Provide a continuous 1/2" square plated steel axle mechanically attached to blade and external (out of airstream) blade-to-blade linkage. Provide bronze or oilite bearings. Dampers shall be suitable for 1500 feet per minute velocity and a maximum pressure of 3"W.G. for up to a 24-inch wide damper when closed. Damper shall have a maximum pressure drop of 0.1"W.G. at 1500 feet per minute through a 24-inch x 24-inch damper.
2.5 DUCT ACCESS DOORS

A. Square Frame Access Doors
   1. Low Pressure Ductwork
      a. Construct outer frame of minimum 22 gauge roll formed galvanized steel with installation tabs. Door shall be removable double wall door constructed of 24 gauge galvanized steel and insulated with 1-inch of insulation (R-4). Provide minimum 2 manually operated cam locks on access doors 16-inches and under, 4 cam locks for doors greater than 16-inches. Provide foam gasket seal between door and frame and between frame and duct.
      b. Performance. 24”x24” access door shall be suitable for up to 2”W.G. and have a maximum leakage of 0.15 CFM/sq.ft. at 1”W.G. pressure.

2. Medium Pressure Ductwork
   a. Construct outer frame of minimum 22 gauge roll formed galvanized steel with installation tabs. Door shall be removable double wall door constructed of 24 gauge galvanized steel and insulated with 1-inch of insulation (R-4). Provide minimum 4 manually operated cam locks on access doors 16-inches and under, 8 cam locks for doors greater than 16-inches. Provide foam gasket seal between door and frame and between frame and duct.
   b. Performance. 24”x24” access door shall be suitable for up to 10”W.G. and have a maximum leakage of 0.15 CFM/sq.ft. at 1”W.G. pressure.

B. Round “Spin” Access Doors
   1. Construct outer frame of minimum 22 gauge roll formed, double hemmed galvanized steel. Door shall be revolvable double wall door constructed of 24 gauge galvanized steel and insulated with 1-inch of insulation (R-4). Provide minimum 3 manually operated cam locks on access door. Provide continuous foam gasket between door and frame.

C. Where duct size permits, access door size shall be 18-inches in diameter or 18” x 16” for oval and rectangular doors. For duct sizes under 20-inches, provide access door 2-inches smaller than duct size. For ducts 12-inches wide, provide minimum 10” x 12”.

2.6 CONICAL SPIN-IN FITTINGS AND TAPS

A. General Construction. For stainless steel ductwork, provide stainless steel finish to match ductwork material.

B. Furnish conical spin-in fittings with quadrant dampers at all round runout ducts serving diffusers and grilles. Fabricate conical fitting of 26-gauge galvanized sheet metal with 2-inch build out, continuous 3/8” square shaft, air tight nylon bushings and locking quadrant handle. Connect damper plate to shaft with a minimum 2 u-bolts on dampers 12-inches and greater.

2.7 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. Drill temporary test holes for balancing in ducts as required. Cap with neoprene plugs, threaded plugs, or threaded or twist-on metal caps. Provide neat patch on external duct insulation and label as “Test Plug”.

AIR DUCT ACCESSORIES 23 3300 - 5
C. Provide permanent test holes in ductwork upstream and downstream of all coils, fans, and locations as indicated on drawings. Test holes shall be factory fabricated, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.8 LABORATORY EXHAUST ACCESSORIES

A. C.A.T.S. E-Z Joint Connector. Provide Type 316L stainless steel round duct joint connector for connection of ductwork at lab exhaust valve as indicated in drawing details. Product shall be manufactured by Standard Sheet Metal Works. System shall consist of ½” flanged end duct connectors meeting requirements of SMACNA, and suitable up to 30"W.G. positive/negative pressure. System shall include Nitril/PVC blend gasketing.

B. Fernco Fitting. Provide Fernco coupling at fume hood connection as indicated in drawing details. Coupling shall resistant to UV and conform to ASTM D5926. Provide two stainless steel clamps for connection to ductwork. Coupling shall be suitable for temperatures between -30°F and 140°F and pressures up 4.3 psig.

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 ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. 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.
   2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

3.2 ACCESS DOORS

A. Install duct access doors on sides or bottom of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. Upstream and downstream of duct mounted duct coils.
   2. At duct mounted smoke detectors.
   3. Upstream or Downstream of turning vanes.
   4. Elsewhere as indicated on drawings, details or specifications.
B. Label access doors according to Section 23 0553 - Identification for HVAC Piping and Equipment to indicate the purpose of access door.

3.3 FIRE, SMOKE AND COMBINATION FIRE/SMOKE DAMPERS

A. Install dampers at locations indicated on the drawings and in accordance with manufacturer's UL approved installation instructions.

B. Install dampers square and free from racking with blades running horizontally.

C. Do not compress or stretch damper frame into duct or opening.

D. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jackshaft.

E. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

F. Provide access doors for all fire, smoke and combination fire/smoke dampers. Refer to details for additional requirements.

3.4 CONICAL SPIN-IN FITTINGS AND TAPS

A. Install conical spin-in fittings with quadrant dampers to serve diffusers as indicated on drawings.

B. After installation of spin-in fitting, seal all around connection to meet leakage class indicated in Specification 23 3113.

3.5 VOLUME CONTROL DAMPER

A. 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.

B. Set dampers to fully open position before testing, adjusting, and balancing

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Operate all volume 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/smoke dampers to verify full range of movement per NFPA and verify that proper heat-response device is installed.

END OF SECTION
SECTION 23 3713
AIR DEVICES

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes air distribution devices including the following:
   1. Diffusers.
   2. Grilles.
   3. Registers.

1.2 COOPERATION WITH OTHER TRADES
A. Coordinate work with Division 26 Electrical Sections to ensure intended functions of lighting and air systems are achieved.

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.
B. Samples: At the request of the Owner and/or A/E team, submit each exposed product for each color and texture specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Products meeting all requirements of this specification Section of the following manufacturers are acceptable:

2.2 DIFFUSERS
A. Square Plaque Diffuser (MARK A, P):
   1. Provide aluminum plaque diffuser, precision formed back cone of one piece seamless construction which incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct. An inner plaque assembly shall be incorporated that drops no more than 1/4 inch below the ceiling plane to assure proper air distribution performance. The inner
plaque assembly shall be completely removable from the diffuser face to allow full access
to any dampers or other ductwork components located near the diffuser neck.
2. Finish shall be White Powder Coat.
3. Provide transitions for rectangular duct connections if required.

B. Perforated Return/Exhaust (MARK C, CC, D, DD, R, RR, S, SS, TT):
1. Provide steel frame construction with aluminum perforated face and white factory finish. Frame the diffuser face with a mitered and welded frame.
2. Face shall have no less than 51% free area.
3. Provide curved blade air deflector modules located in the neck of the diffuser.

C. Flush Faced Radial (Laboratory) Diffusers (MARK G, H):
1. Air diffuser shall provide a flush face, non-aspirating radial air pattern, projecting air horizontally, vertically in a radial direction.
2. Shall be constructed of 6 inch tall stainless steel back pan. All pattern controllers shall be internal to the unit. Provide foam gasketing.
3. The face of the diffuser shall be constructed of perforated stainless steel, and shall not protrude below the ceiling. Provide white finish on face and frame.

2.3 ACCESSORIES

A. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like a grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
1. Furnish frames with 1/2 inch thick sponge rubber gasket to prevent air leakage.
2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

2.4 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 INSTALLATION

A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been properly approved. Remove and reinstall any part of the installation found incorrect.

B. Diffusers. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets securely to ductwork with sheet metal screws. For perforated diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling on which the diffuser is installed.

C. Radial Diffusers. Install per manufacturer's recommendations and as indicated in details. All radial diffusers to be independently hung from structure.
3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION
PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials and equipment required for complete and functioning electrical systems as required by the contract documents.

B. New Work. The work includes, but is not limited to, the following principal systems and equipment:
   1. 480/277 volt distribution.
   2. 208/120 volt distribution.
   4. Automatic transfer switches.
   5. Luminaires, lamps and ballasts.
   6. Fire alarm system.
   7. Lighting controls.
   8. Grounding and bonding system.
   10. Variable frequency drives for AC electric motors. Furnished by Division 23, installed by Division 26.
   12. Synchronous clock system.

C. Empty Raceway. Refer to Division 27 telephone/data and Division 28 security specifications for cabling requirements. Provide empty raceway for the following systems:
   1. Communications: Computer system cables and outlets. Refer to telecommunications Drawings for additional work.
   2. Communications: Telephone system cables and outlets. Refer to telecommunications Drawings from additional work.

D. Demolition. Refer to demolition Drawings and Section 26 0100 for scope of work.

1.2 APPLICABLE PROVISIONS

A. Provisions Specified Elsewhere. Unless modified in this Section, General and Supplementary General Conditions, applicable provisions of Division 01 - General and other provisions of contract documents apply to work of Division 26 - Electrical.

B. Application. Provisions of this Section apply to every section of Division 26 - Electrical, except where specifically modified.

C. Work covered by this Section shall be accomplished in accordance with applicable provisions of the Contract Documents and addenda or directives which may be issued herewith, or otherwise.
1.3 RELATED WORK
   A. Existing Conditions - Division 02.
   B. Concrete - Division 03.
   C. Sealing and Firestopping – Division 07.
   D. Openings - Division 08.
   E. Finishes - Division 09.
   F. Equipment - Division 11.
   G. Furnishings – Division 12.
   H. Special Construction – Division 13.
   K. Plumbing – Division 22.
   L. Heating, Ventilation and Air Conditioning – Division 23.
   M. Communications – Division 27.

1.4 REFERENCE CODES AND STANDARDS
   A. Standards of the following organizations may be referenced in the specification. Unless noted otherwise, references are to standards or codes current at the time of bidding.
   B. Association of Edison Illuminating Companies (AEIC).
   C. American National Standards Institute (ANSI).
   D. Institute of Electrical and Electronics Engineers (IEEE).
   E. Insulated Cable Engineers Association (ICEA).
   F. National Electrical Code (NEC).
   G. National Electrical Manufacturers Association (NEMA).
   I. National Fire Protection Association (NFPA).
1.5 REGULATIONS AND PERMITS

A. Regulations. Work, materials and equipment must comply with the latest rules and regulations of the following:
   3. Occupational Safety and Health Act (OSHA).
   4. Americans with Disabilities Act (ADA).
   5. Texas Department of Licensing and Regulation (TDLR).
   8. State and federal codes, ordinances and regulations.

B. Discrepancies. The drawings and specifications are intended to comply with listed codes, ordinances, regulations and standards. Where discrepancies occur, immediately notify the Owner's representative in writing, including a proposed resolution, and ask for an interpretation. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirements, provide those specified or shown.

C. Permits: Obtain certificates of inspection and other permits required as a part of the work. Submit written evidence to the Owner's Representative and Architect/Engineer that the required permits and inspections have been secured.

1.6 DRAWINGS AND CONTRACT DOCUMENTS

A. Intent: The intent of the construction Drawings or contract documents, hereinafter referred to as the "Drawings", is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system. The Drawings, specifications, and related contract documents are cooperative, and work or materials called for in one and not mentioned in the other shall be provided. Electrical Drawings, are generally diagrammatic and show approximate location and extent of the work. Review pertinent Drawings and adjust the work to conditions shown. Install the work complete, including minor details necessary to perform the function indicated.

B. The Contractor shall carefully investigate structural and finish conditions, and shall coordinate the work in order to avoid interference between the various phases of work. The Contractor shall be responsible for the proper routing of raceways, subject to prior review by the Owner's Representative. Work shall be organized and laid out in finished portions of the building so that it will be concealed in furred chases, suspended ceilings, and similar elements of the building, unless specifically noted to be exposed. Work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. Discrepancies: In case of doubt as to work intended, or if amplification or clarification is needed, or where discrepancies occur between Drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer and the Owner's Representative in writing, requesting an interpretation, and include a proposed solution.
D. Dimensions: Dimensional information related to new structures shall be taken from the appropriate Drawings. Dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.

E. Outlet and Equipment Locations: Coordinate the actual locations of electrical outlets and equipment with building features and equipment as indicated on architectural, structural, mechanical, telecommunications, audio-visual (AV), security, plumbing, and laboratory Drawings. Review with the Owner’s Representative proposed changes in outlet and equipment location. Relocation of outlets before installation of up to 5 feet from the position indicated may be directed without additional cost to the Owner. Remove and replace outlets placed in unsuitable locations, when so requested by the Owner’s Representative, and at no additional cost to Owner.

1.7 SUBMITTALS

A. Submit the following in addition to and in accordance with the requirements of the Uniform General Conditions and in Division 01, Submittals.

1. Include inspection and permit certificates and certificates of final inspection and acceptance from the authority having jurisdiction.

2. Manufacturer’s standardized schematic diagrams and catalog cuts shall not be acceptable unless applicable portions are clearly indicated, and non-applicable portions clearly deleted or crossed out.

3. Schematic, connection and/or interconnection diagrams.

4. Provide submittals as required by individual specification section.

B. Provide the following with each submittal:

1. Catalog cutsheets with manufacturer’s name clearly indicated. Applicable portions shall be clearly indicated by arrows, circles, or similar markings and non-applicable portions shall be clearly deleted or crossed out.

2. Line-by-line specification review by equipment manufacturer and contractor with exceptions explicitly defined.

3. Itemize and organize equipment and material submittals by specification Section number; include manufacturer and identifying model or catalog numbers.

a. Submittal packages for product data, shop drawings, and other required submittals shall be numbered sequentially according to the applicable specification Section number. For example, the first submittal package for Energy-Efficient Dry-Type Transformers shall be identified as Submittal number 262213-01. The second submittal package for Energy-Efficient Dry-Type Transformers would be identified as Submittal number 262213-02. Re-submittal packages shall be identified by an “R” in the sequential numerical suffix.

b. Where directed by the Owner or the Architect to combine submittals into a common package, the submittal data may be organized in one or more 3-ring binders or similar container. Product data, shop drawings, and other submittal data shall be organized in separate tabs according to paragraph 1.07B.3a, above. That is, submittal data in individual tabs of a common submittal package shall be numbered sequentially, according to the applicable specification Section number.

4. Replace rejected items and resubmit with acceptable items in accordance with the requirements of Division One for Submittals, and with the Uniform General Conditions.

C. Within the specified time window after award of contract, submit list of equipment and materials to be furnished.

1. Itemize equipment and material by specification section number; include manufacturer and identifying model or catalog numbers.
2. Replace rejected items with an acceptable item within 2 weeks after notification of rejection.

3. If a satisfactory replacement is not submitted within a two-week period, Owner will notify contractor as to equipment manufacturer or type and make or material to be furnished. Provide designated items at no additional cost to Owner.

D. Equipment Layout Drawing: 1/8-inch scale minimum drawings indicating electrical equipment locations. Dimensions for housekeeping pads shall be indicated on these drawings. Indicate routing of conduit 2 inches and over on these drawings.

E. Drawings: The Contractor shall prepare one complete set of composite drawings. The shop drawings for sheet metal ductwork shall be used as the basis for this coordination. When the sheet metal drawings have been prepared, the raceway, luminaires, mechanical piping, plumbing piping, and fire protection piping shall be overlaid and drafted onto the composite drawing. The intent of this process is to define areas of potential conflict and resolve those conflicts prior to fabrication or installation of work. In areas of congestion (where simply overlaying and drafting will create an unreadable product), the plan view scale shall be increased and multiple layered views shall be developed. Elevations of the individual elements shall be established, and elevations shall be drawn to illustrate that the ductwork, piping, raceway, and other systems and components will co-exist within the available space, and that the proper access to equipment, luminaires, valves, filters, etc. has been established for operation, service, removal and replacement. In addition to the above, the Contractor shall also submit the following for review:
   1. Building Information Modeling (BIM). Where a BIM-model of the project has been developed by the Architect/Engineer or Contractor, the BIM model may be used to develop and produce the coordination drawings. The Contractor and the individual trades shall confirm in writing that the BIM-model and related coordination drawings accurately match the components and systems to be fabricated and installed.
   2. Review: The completed “Composite Drawings” shall be submitted to the Architect/Engineer for review prior to installation. Work that proceeds without appropriate coordination and review will be subject to removal and relocation at no additional cost to the Owner.

F. Installation: Where product data or shop drawings are required, do not install equipment or materials until submittals are accepted by the Architect/Engineer and by Owner's Representative. Use only equipment and materials accepted by the Architect/Engineer and by Owner’s Representative. Equipment and materials installed prior to acceptance by the Owner/Engineer and Owner’s Representative shall be removed at no additional cost to Owner and replaced at the Contractor’s expense.

G. Startup and Test Procedures:
   1. Furnish documentation from equipment manufacturer for the startup and field testing procedures for equipment installed as a part of this project.
   2. Startup and testing procedures shall include prerequisite conditions, system and equipment alignments and lineups, sequential steps for execution of the test, shutdown procedures, and criteria for satisfactory test completion and test failure.
   3. Startup and testing procedures shall address and demonstrate modes of system or equipment operation, including startup, manual, unattended/automatic, and shutdown procedures, as well as procedures for testing and demonstration of abnormal or emergency operating conditions.
   4. Include forms and logs to be used during field testing. Forms and logs shall include the range of permissible values for monitored parameters, as applicable.

H. As-Built and Record Drawings:
   1. Maintain a master set of as-built drawings that show changes and other deviations from the Drawings. The markups shall be made as the changes are done. The markups shall show
the actual changes and shall not reference RFI’s, ASI’s etc. The record drawing shall be a complete standalone document clearly showing all changes that differ from the design drawings. Any references to RFI’s, ASI’s etc. will result in a rejection of the record drawings.

2. At the conclusion of the project, these as-built drawings shall be transferred to AutoCAD electronic files, in a format acceptable to the Owner’s Representative, and shall be complete.

3. Prior to final acceptance, deliver to the Owner’s Representative the AutoCAD electronic files, the complete set of record drawings showing the as-built condition of the project, and the actual field set of as-built drawings. Also deliver one set of as-built drawings on CD-Rom or similar electronic media acceptable to the Owner. Drawing files shall be in AutoCAD (.dwg) and Adobe Acrobat (.pdf).

4. Quantity: In accordance with the requirements of Division One and the General Conditions. Where not specified elsewhere, provide 3 hard copies plus one reproducible set.

I. Operating and Maintenance Manuals: As specified in Part 3 of this Section and in Division One, as applicable.

1.8 SUBSTITUTIONS

A. Refer to requirements of Division One for substitution of Material and Equipment.

B. Product manufacturers are listed to establish a level of quality for the products. Substitutions may be allowed if the product is equal to or better than what is listed in the design guidelines, as determined by the Architect/Engineer and owner’s Representative upon submittal of comparison products.

C. Samples: When requested by the Owner’s Representative or the Architect/Engineer, the Contractor shall provide a sample of the proposed substitute item. When requested, provide samples of both the specified item and the proposed item for comparison purposes.

D. Timeliness: The burden of timeliness in the complete cycle of submittal data, shop drawings, and sample processing is on the Contractor. Time periods for Architect/Engineer processing and review of submittal data, shop drawings, samples, studies, and reports shall be in accordance with the applicable submittal and substitution requirements of Division One and the General Conditions. The Contractor shall allow sufficient time for review of each submission by the office of the design discipline involved after receipt of such submissions by that design discipline. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles for processing of submittal data and shop drawings, including time for resubmittal cycles on unacceptable and rejected materials, equipment, components, and systems covered by the data submitted. Construction delays and lack of timeliness in the above regard are the responsibility of the Contractor and will not be considered in requests for scheduled construction time extensions and additional costs to the Owner.

E. Acceptance: Acceptance of materials and equipment will be based on manufacturer’s published data and will be tentative subject to the submission of complete shop drawings indicating compliance with the Drawings, specifications, and other applicable Contract Documents, and that adequate and acceptable clearances will exist for entry, servicing, and maintenance. Acceptance of materials and equipment under this provision shall not be construed as authorizing deviations from the Specifications, unless the attention of the Owner’s Representative and the Architect/Engineer has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless pertinent information is properly identified.
F. Replacement: Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended within the guarantee period, this material or equipment shall be replaced with the material or equipment originally specified at no additional cost to the Owner.

1.9 CONTRACTOR QUALIFICATIONS

A. An acceptable Contractor for the work under this division must have personnel with experience, training and skill to provide a practical working system.
   1. The Contractor may be required to furnish acceptable evidence of having installed not less than three systems of size and type comparable to this project. The systems must have served satisfactorily for not less than 3 years. The superintendent must have had experience in installing not less than three such systems.
   2. The Contractor must have personnel with the proper licenses to perform electrical work under this Contract. In accordance with the Texas Electrical Safety and Licensing Act – Title 8, Occupation Code, Chapter 1305, Subchapter D, section 1305.151: “LICENSE REQUIRED. Except as provided by Section 1305.003, a person may not perform electrical work unless the person holds an appropriate license issued or recognized under this chapter.”

B. The Contractor shall follow the safety procedures in addition to, and in accordance with, the requirements of the Project Safety Manual (PSM).
   1. The Contractor shall be responsible for training personnel under their employ in areas concerning safe work habits and construction safety. The Contractor shall continually inform personnel on hazards particular to this project and update the information as the project progresses.
   2. The Contractor shall secure electrical rooms, to limit access, prior to energizing high voltage (1000V or higher) equipment, and shall control access during the project after energization. The Contractor shall post and maintain warning and caution signage in areas where work is ongoing near energized equipment. The Contractor shall cover energized live parts when work is not being done in the equipment. This includes lunch and breaks.
   3. The Contractor shall strictly enforce OSHA lockout/tagout procedures. Initial infractions shall result in a warning. A second infraction shall result in the removal of the workman and his foreman from the site. Continued infractions shall result in removal of the Contractor from the site.

1.10 TEMPORARY CONSTRUCTION SERVICE

A. The contractor is responsible for coordinating construction power per the Owners Special Conditions.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Condition. Provide new products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type of product specified.
B. NEC and UL.
   1. Products must conform to requirements of the National Electrical Code. Where Underwriters' Laboratories have set standards, listed products and issued labels, products used must be listed and labeled by UL.
   2. Materials and equipment shall be labeled and/or listed as acceptable to the authority having jurisdiction as suitable for the use intended. Where no specifications or specific model numbers are given, provide materials of a standard industrial quality.

C. Space Limitations: Equipment selected must conform to the building features and must be coordinated with them. Electrical installation shall comply with the requirements of Article 110.26 and Article 110.34 of the National Electrical Code (NEC) for working space, access, and dedicated equipment space. Do not provide equipment that will not suit arrangement and space limitations. Scaled drawings (1/4" = 1'-0") of electrical and telecommunication rooms shall be submitted for review by the Architect/Engineer and the Owner’s Representative prior to installing equipment. See paragraph 1.07E above.

D. Factory Finish. Equipment shall be delivered with a hard surface, factory-applied finish so that no additional field painting is required except for touch-up as required.

E. Physical Size of Equipment: Equipment of larger sizes than shown, even though of specified manufacturer, will not be acceptable unless the Contractor demonstrates by product data, shop drawings, and coordination drawings that ample space exists for proper installation, operation, and maintenance.

F. Enclosure: Provide NEMA 1 enclosure for indoor installation and NEMA 3R for outdoor enclosure, unless noted or specified otherwise. The enclosure shall be suitable for the environment per NEC, NEMA and ANSI standards.

G. Conductors in Conduit: Conductors shall be installed in conduit. Exceptions are listed in individual Sections of the Division 26 and Division 28 specifications.

H. Non-Ferrous: Use non-ferrous materials in rooms with equipment employing magnetic equipment with elevated gauss fields, such as Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) equipment. Use non-ferrous materials where gauss fields extend into adjacent spaces, and other locations as indicated on Drawings.

2.2 MANUFACTURER

A. Where two or more units of the same class of material are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer, except as specifically noted in individual Sections of the specifications.

B. Common Source:
   1. Generator, Automatic Transfer Switches, and Bypass-Isolation Switches: Equipment specified in Sections 26 3214, 26 3623, and 26 3625 shall be provided by the same supplier, and shall be the responsibility of the supplier for the packaged electric generating plant. Responsibility for warranty service shall not be a justification for substitution of products of a manufacturer other than those listed for equipment in the individual Sections 26 3214, 26 3623, and 26 3625.
2.3 **SUBSTITUTIONS**

A. Refer to Division 01 section on Material and Equipment, and to paragraph 1.08 of this Section.

2.4 **NAMEPLATES AND DEVICE MARKING**

A. Refer to Section 26 0553, Identification for Electrical Systems.

2.5 **AUTOMATED EQUIPMENT AND CONTROLS**

A. Equipment and control systems where applicable, shall match, integrate, communicate and cooperate with new and existing systems, such as building automation, energy management, direct digital controls (DDC), fire detection and alarm, circuit breakers, transformers, etc.

**PART 3 - EXECUTION**

3.1 **GENERAL**

A. Manufacturer’s Recommendations: The manufacturer’s published directions shall be followed in the delivery, storage, protection, installation, wiring, and connection of equipment and material. Promptly notify the Architect/Engineer and the Owner’s Representative in writing of conflicts between the requirements of the Drawings and specifications and the manufacturer’s directions, in accordance with paragraphs 1.05B and 1.06C of this Section. Obtain instructions from the Owner’s Representative before proceeding with the work. Should the Contractor perform work that does not comply with the manufacturer’s directions or such instructions from the Owner’s Representative, he shall bear costs arising in connection with the deficiencies.

B. Site Observation: Site observation by the Architect/Engineer is for the express purpose of verifying compliance by the Contractor with the Drawings, specifications, and other applicable Contract Documents. Site observation by the Architect/Engineer shall not be construed as construction supervision, or indication of approval of the manner or location in which the work is being performed, or as being a safe practice or place. Site observation by the Architect/Engineer shall not be construed as inspection by the Authority Having Jurisdiction (AHJ) or other applicable code enforcement authority.

C. Installation: Where product data or shop drawings are required, do not install equipment or materials until submittals are accepted by the Architect/Engineer and by the Owner’s Representative. Use only equipment and materials accepted by the Architect/Engineer and the Owner’s Representative. Equipment and materials installed prior to acceptance by the Architect/Engineer and Owner’s Representative shall be removed at no additional cost to Owner and replaced at the Contractor’s expense.

D. Supervision:

1. The Contractor of the work under this Division shall keep a competent superintendent or foreman on the job throughout the period of construction. Refer to Division One requirements and the Uniform General Conditions for additional information concerning supervision.

2. It shall be the responsibility of such superintendent to study the Drawings, specifications, and other applicable Contract Documents, and familiarize himself with the work. He shall
coordinate his work with other trades before material is fabricated or installed, and ensure that his work will not cause interference with another trade. Where interferences are encountered, they shall be resolved at the job site by the Contractor. Where interferences cannot be resolved without major changes to the Drawings, the matter shall be referred to the Architect/Engineer and the Owner’s Representative for resolution in accordance with paragraphs 1.05B and 1.06C of this Section.

3.2 PROTECTION OF EQUIPMENT AND MATERIALS

A. General:
   1. The Contractor shall follow the manufacturer’s directions completely in the delivery, storage and handling of equipment and materials.
   2. Equipment and materials shall be tightly covered and protected against dirt, water, chemical, physical or weather damage and theft. At the completion of the work, fixtures, equipment and materials shall be cleaned and polished thoroughly and shall be returned to “as new” condition.
   3. Electrical cable, wire, and conductors shall be stored to prevent moisture and mechanical damage.

B. Moisture. During construction, protect switchboard, transformers, motors, control equipment, and other items from insulation moisture absorption and metallic component corrosion by appropriate use of strip heaters, lamps or other suitable means. Apply protection immediately on receiving the products and maintain continually.

C. Clean. Keep products clean by elevating above ground or floor and by using suitable coverings.

D. Damage. Take such precautions as are necessary to protect apparatus and materials from damage. Failure to protect materials is sufficient cause for rejection of the apparatus or material in question.

E. Finish. Protect factory finish from damage during construction operations and until acceptance of the project. Satisfactorily restore finishes that become stained or damaged.

F. Weather. Protect equipment and materials from weather and sunlight by use of suitable coverings and storage indoors, or in suitable weather-protected containers. Materials and equipment marked by their manufacturer as suitable for storage outdoors may be stored according to manufacturer’s markings. Maintain factory-installed coverings and wrappings until material is to be installed.

3.3 SAFETY

A. Implement the following safety procedures in addition to, and in accordance with, the requirements of Division One and the Uniform General Conditions:
   1. The Contractor shall be responsible for training personnel under their employ in areas concerning safe work habits and construction safety. The Contractor shall continually inform personnel of hazards particular to this project and update the information as the project progresses.
   2. Prior to energizing panelboards within the scope of work, secure affected electrical rooms to limit access to line voltage. Line voltage shall be defined as above 50 volts, for the purpose of controlling access. During and after energization of panelboards, control access to electrical rooms for the duration of the project. Post and maintain warning and caution.
signage in areas where work is on-going near energized equipment. Cover energized live parts when work is not being done in the equipment. This includes lunch and breaks.

3. Strictly enforce OSHA lockout/tagout procedures. Initial infractions shall result in a warning. A second infraction shall result in the removal of the workman and his foreman from the site. Continued infractions shall result in removal of the Contractor from the site.

3.4 INSPECTION

A. Examination. Examine the areas and conditions under which equipment and systems are to be installed, and notify the Owner’s Representative in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Coordination. Carefully investigate structural and finish conditions and coordinate the work in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases, suspended ceilings, and similar elements in finished portions of the building, unless specifically noted to be exposed. Work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

3.5 INSTALLATION

A. Cooperation with Other Trades. Cooperation with trades of adjacent, related or affected materials or operations, and of trades performing continuations of this work under subsequent contracts, is considered a part of this work in order to effect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades. Provide other trades, as required, templates, patterns, setting plans and shop details for the proper installation of the work and for purposes of coordinating adjacent work. Electrical power connections for mechanical and plumbing equipment are in this Division unless noted otherwise. Verify electrical characteristics of equipment with other Divisions before roughing in the electrical connections.

B. Workmanship. Work shall be performed by workmen skilled in their trade. The installation shall be complete and installed in a neat and workmanlike manner in accordance with NEC 110.12 and FPM accompanying, and as described in ANSI/NECA 1-2000 “Standard Practices for Good Workmanship in Electrical Contracting”, and other ANSI approved installation standards.

C. Concrete Equipment Pads.
   1. Refer to structural Drawings and specifications for design criteria.
   2. Where not otherwise indicated, install 3-1/2 inch thick concrete foundation pads for indoor floor-mounted equipment, except where direct floor mounting is required. For equipment mounted outdoors, provide concrete foundations a minimum of 6 inches above grade. Provide reinforcing steel as recommended by the structural engineer and as detailed on the Drawings. 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.
   3. 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.
D. 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.
   1. Equipment must be leveled and set plumb.
   2. Sheet metal enclosures mounted against a wall shall be separated from the wall not less than 1/4 inch by means of corrosion-resistant spacers, or by 3 inches of air for freestanding units. Use corrosion-resistant bolts, nuts and washers to anchor equipment.
   3. In sufficient time to be coordinated with work under other divisions, provide shop drawings and layout work showing exact size and location of sleeves, openings or inserts for electrical equipment in slabs, walls, partitions and chases.
   4. Provide adequate support for freestanding panels, switchboards, enclosures, and other equipment. This shall include bolting to the floor, concrete equipment pad, or solid structural steel to prevent tipping. Install free-standing electrical equipment on concrete equipment pads in accordance with paragraph 3.05C, this Section, except where equipment is noted and designed for mounting directly on the concrete floor slab. Under no condition shall equipment be fastened to non-rigid building steel such as removable platform steel gratings, handrails, etc.
   5. Provide racks and supports, independently mounted at structure, to support electrical equipment and systems supplied and installed under this contract. Do not mount or suspend equipment from supports provided for equipment and systems by other Divisions, except where specifically noted or indicated on Drawings.
   6. Refer to Section 26 0529, Metal Framing and supports, for additional requirements.

E. Sealing of Equipment.  Seal openings into equipment to prevent entrance of animals, birds and insects, as well as to prevent ingress of moisture, dust, dirt, and similar contaminants.

F. Motors.
   1. Motors are specified in Divisions 21, 22 and 23.
   2. Electrical work includes the electrical connection of motors, except those which are wired as a part of equipment.
   3. Refer to Division 23 and other applicable Divisions for wiring and connection of motors and equipment furnished by those Divisions.
   4. The Contractor shall note that the electrical Drawings are based on the equipment scheduled and indicated on the Drawings. Should mechanical equipment be provided requiring changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.
   5. Provide interconnecting wiring for the installation of the power required. Provide disconnect switches as required for proper operation, as indicated on the Drawings or required by applicable code. Combination starters, individual starters, and other motor starting apparatus, not specifically scheduled or specified as provided by the equipment manufacturer under the scope of other Divisions shall be provided under the scope of Division 26.
   6. Other Divisions will provide complete wiring diagrams indicating power wiring and interlock wiring. Diagrams shall be submitted to the Architect/Engineer for review. Diagrams will be based on accepted equipment and be complete full phase and interlock control drawings, not a series of manufacturer’s individual diagrams. They will be followed in detail. For additional clarification, refer to Division 23, Controls.

G. Concealed Work. Conceal electrical work in walls, floors, chases, under floors, underground and above ceilings except:
   1. Where shown or specified to be exposed. Exposed is understood to mean open to view.
   2. Where exposure is necessary to the proper function.
3. Where size of materials and equipment preclude concealment. Obtain the written consent of the Owner’s Representative and the Architect/Engineer to leave materials exposed in finished spaces of the building.

H. Application. Unless otherwise indicated, power will be utilized as follows:
   1. 480 volts, three phase: motors 3/4 horsepower and larger.
   2. 120 volts, single phase: motors 1/2 horsepower and smaller.
   3. 277 volts, single phase: fan powered boxes.
   4. 120 volts, single phase: incandescent lighting.
   5. 277 volts, single phase: fluorescent and high-intensity-discharge lighting.
   6. 120 volts, single phase: convenience outlets, dedicated equipment, lab-track terminal boxes without fans.
   7. 208 volts, single and three phase: specialty outlets.
   8. 460 volts, three phase: special power and equipment; verify for each unit of equipment.

I. Transformers. Use transformers to change the service to the required utilization voltages.

J. Connections to Equipment - Other than Division 26. For equipment furnished under other Divisions, and for equipment furnished by the Owner, provide final electrical connections to such items of equipment. Obtain detailed shop drawings of equipment from the applicable Division or supplier indicating the exact number and location of rough-in points. Such final shop drawings may indicate adjustments in total number and exact location of rough-in points, and in equipment dimensions. Making adjustments to field conditions is considered a part of the work required.
   1. Roughing-in: When roughing-in, provide electrical branch circuits to various items of equipment. Terminate at proper points as indicated on detailed equipment shop drawings, or as directed. Use Drawings accompanying these specifications only for general routing of circuiting. Do not use Drawings accompanying these specifications for rough-in locations.
   2. Final Connections: Millwork, casework, and similar equipment will include service fittings such as switches, duplex receptacles, data/communications outlets, and luminaires on the casework or equipment. Provide branch circuit connection to match electrical connection requirements of service fittings.

K. Accessories. Offsets, fittings, expansion joints, anchors and accessories that are required for a complete system shall be provided, even if not specifically indicated on the Drawings or mentioned in the specifications. Offsets, transitions and changes in direction of conduit, cable trays, raceways and busways shall be made to maintain proper headroom. Provide pullboxes, fittings, etc., required as a result of these transitions and changes in direction.

L. Observation prior to cover-up or seal-in of walls and ceilings. Perform the following in accordance with the applicable requirements of Division One and the General Conditions:
   1. Prior to the installation of ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner’s Representative so that arrangement can be made for observation or inspection of the above-ceiling area about to be “sealed” off. The Contractor shall provide advance notice in accordance with the applicable requirements of Division One and the General Conditions. Where not specified, required, or directed elsewhere, provide not less than 10 working days’ advance notice.
   2. Above-ceiling areas will be subject to a formal inspection before ceiling panels are installed, or installation is otherwise concealed from view. Electrical work at and above the ceiling, including items supported by the ceiling grid, shall be complete and installed in accordance with contract requirements, including power to luminaires, fans, and other powered items. The purpose of this inspection is to verify the completeness and quality of the installation of the electrical systems and other above ceiling special systems such as cable tray systems.
The ceiling supports shall be in place so that access panel and luminaire locations are identifiable, and so that clearances and access provisions may be evaluated.

3. No ceiling materials may be installed until the resulting deficiency list from this inspection is completed and approved by the Owner’s Representative.

M. Finish. Coordinate with Division 9 to paint exposed conduit to match adjacent walls, unless otherwise directed.

3.6 EXISTING FACILITIES

A. Responsibility. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and maintenance of electrical services for new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing such temporary protection upon completion of the work.

B. Services. The Contractor shall provide temporary or new services to existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

C. Access. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, luminaries, air conditioning ductwork and equipment, etc., to provide this access, and shall reinstall same upon completion of work in the areas affected.

D. Existing Devices. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, remove and reinstall in locations approved by the Architect/Engineer devices required for the operation of the various systems installed in the existing construction. This is to include, but is not limited to, temperature controls, system devices, electrical switches, relays, luminaires, fixtures, piping, conduit, etc.

E. Outages. Outages of services as required by the new installation will be permitted, but only at a time approved by the Owner. The Contractor shall coordinate with the Owner’s Representative to arrange for service outages. The Contractor shall allow the Owner sufficient time to schedule for required outages, in accordance with the applicable requirements of Division One and the General Conditions. Where not specified, required or directed elsewhere, allow a minimum of 21 working days for the Owner to schedule for required outages. The time allowed for outages will not be during normal working hours or during hours of research and instruction, unless otherwise approved by the Owner’s Representative. Costs of outages, including overtime charges, shall be included in the contract amount.

F. Adjacent Facilities. Coordinate work among the various trades to minimize disruption to existing processes, procedures, and equipment in spaces adjacent to areas of demolition and renovation work. Coordinate with Owner’s Representative to schedule work producing noise or structure-borne vibrations, including but not limited to cutting, drilling, coring, and use of impact tools.

G. Refer to Section 26 0002, Demolition, for additional requirements.
3.7 EQUIPMENT AND DEVICE MARKING

A. Designations. Identify equipment, devices, feeders, branch circuits and similar items with the same designations as indicated on the Drawings.

B. Nameplates. Externally mark electrical equipment with nameplates identifying each and the equipment served. Supply blank nameplates for spare units and spaces.

C. Refer to Section 26 0553 for additional requirements.

3.8 SLEEVES, PENETRATION, CUTTING AND PATCHING

A. General. Cut and patch walls, floors, etc., resulting from work in existing construction. Provide for the timely placing of sleeves for raceway and exposed cabling passing through walls, partitions, beams, floors and roof while same are under construction. If openings, sleeves, and recesses are not properly installed and cutting and patching become necessary, it shall be done at no expense to the Owner. Secure permission from the Owner’s Representative before cutting or patching a constructed or existing wall. Where roofs or walls are fire rated, penetrations shall be completely sealed using UL-listed materials and procedures sufficient to preserve the fire rating. Comply with special requirements of local authorities.

B. Structure. Do not cut or core through structural beams, joists, load-bearing walls, grade beams, or similar load-bearing structure. Where limited space is available above the ceilings below concrete beams or other deep projections, notify the Owner’s Representative in writing, including a proposed solution, and request a resolution. Approval shall be obtained from the Owner’s Representative and the Architect/Engineer for each penetration.

C. Penetrations.
   1. This contract requires core drilling of floor or wall penetrations as indicated on Drawings. Core drilling shall be in accordance with structural specifications. Floor penetrations shall include a sleeve that extends above the floor 2 inches, except where plugs and caps are specified or indicated flush with floor or foundation pad. Electrical penetrations shall be coordinated with structure during design, and shall be made in compliance with structural requirements specified in the structural Drawings and specifications. Field modifications are required to be reviewed and approved by structural engineer prior to installation.
   2. Penetrations shall be sealed in accordance with the requirements of Division 7, Firestopping. Coordinate with Division 7 to provide firestopping systems and materials that are compatible with the penetrations for systems and equipment furnished and installed under Division 26.
   3. Provide sleeves for conduit penetrations of smoke, fire, and sound rated partitions. Install sleeve with a minimum of 1 inch diameter where penetrating the exterior drywall.
   4. Provide proper sizing of sleeves or core-drilled holes to accommodate their through-penetrating items. In general, provide conduit sleeves two standard sizes larger than their through-penetrating items. Provide larger sleeves as required to allow passage of couplings for through-penetrating items.

D. Sealing and Firestopping.
   1. Voids between sleeves or core-drilled holes and pipe passing through fire-rated assemblies shall be firestopped to meet the requirements of ASTM E 814, in accordance with Division 7 requirements for Firestopping.
   2. Where the routing of cable tray passes through fire-rated walls, floors or other fire-rated boundaries, coordinate with Division 7 to provide removable firestopping system.
3. Furnish and install UL Systems Classified, intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures beginning at 250° F, for the sealing of holes or voids created to extend electrical systems through fire rated floors and walls, in order to prevent the spread of smoke, fire, toxic gas or water.

4. Fire barrier products shall be used to create through-penetration firestop systems as required. Firestop systems shall be listed in the Underwriter’s Laboratories Building Materials Discovery, Through Penetration Firestop Systems (XHEZ).

5. Install firestop materials and systems according to their UL Systems Classifications, manufacturer instructions, manufacturer recommendations, and the requirements of applicable Division 7 specifications.

E. Conduit Sleeves. Conduit sleeve shall be two standard sizes larger than the size of conduit it serves, except where “Link Seal” casing seals are used in sleeves through walls below grade. Sleeves in floor shall extend a minimum of two inches above the finished floor. Conduit passing through concrete masonry walls above grade shall have 18-gauge galvanized steel sleeves. Sleeves set in concrete floor construction shall be at least 16-gauge galvanized steel. Sleeves set in concrete floor construction supporting conduit risers shall be standard weight galvanized steel. Sleeves supporting conduit risers 3 inches and larger shall have three 6 inch long reinforcing rods welded at 120 degree spacing to the sleeve, and shall be installed embedded in the concrete or grouted to existing concrete. Where the conduit passes through a sleeve, no point of the conduit shall touch the sleeve. Seal around penetrations through sleeving as indicated under firestopping as specified herein, and in compliance with the requirements of Division 7 specifications. Galvanized steel requirements can be omitted where not supporting conduits.

F. Penetrations Below Grade. Sleeves penetrating walls below grade shall be standard weight black steel pipe with 1/4-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be two inches wider in radius than the sleeve it encircles. The entire assembly shall be hot-dipped galvanized after fabrication. Seal off annular opening between conduit and sleeve with “Link Seal” casing seal as manufactured by Thunderline Corporation of Wayne, Michigan. Size conduit sleeve to accommodate the casing seal. Use Series 300 casing seals for pipe 3/4-inch through 4-inch and Series 400 casing seals for pipe sized 5-inch and larger.

G. Methods of Cutting: Openings cut through concrete and masonry shall be made with masonry saws and core drills, and at such locations acceptable to the Owner's Representative. Impact type equipment shall not be used except where specifically accepted by the Owner's Representative. Openings in precast concrete slabs for conduits, outlet boxes, etc., shall be core drilled to exact size.

H. Restoration. Restore openings to “as new” condition under the appropriate specification Section for the materials involved, and match remaining surrounding materials and/or finishes.

I. Masonry. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Provide adequate supports during the cutting operation to prevent damage to the masonry caused by the cutting operation. Structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Owner’s Representative.

J. Structure. No cutting, boring, or excavating which will weaken the structure shall be undertaken. Coordinate with structure for placement of conduit, sleeves, and the like through beams, joists, slabs, mats, and other structural components and systems prior to forming of those structural components and systems.
K. Watertight. Where sleeves pass through roof or floors requiring waterproof membrane, lead flashing with a density of at least three pounds per square foot shall be built into the membrane a minimum of six inches to provide a watertight installation. Provide other watertight installation materials as detailed on the Drawings and as specified under Division 7 – Roofing.

L. Escutcheons. Provide heavy chrome-plated or nickel-plated plates on conduit passing through walls and ceilings in finished areas. Escutcheons shall be B&C No. 10, or accepted substitution, chrome-plated steel plates with concealed hinges.

M. Roof Penetrations and Flashings. Furnish and install pipe, conduit and duct sleeves, and flashing compatible with the roofing installation for roof penetrations. Coordinate with Division 7.

3.9 CLEANING, ADJUSTING AND START-UP

A. Cleaning. Clean electrical equipment, components, and devices prior to installation of final finish or covers, prior to startup and testing, prior to final observation by Architect/Engineer and Owner's Representative, and as required under individual Sections of the Division 26 specifications.

B. Adjusting. Adjust equipment, devices, and systems as specified under individual Sections of these Specifications and in accordance with manufacturer’s instructions for proper functioning during modes of operation, including emergency and shutdown conditions.

C. Factory Authorized Representative. Where specified for an individual item of electrical equipment, provide a factory authorized representative for adjustment, start-up, and testing of equipment, and instruction of Owner’s operating personnel. Certify that these services have been performed by including a properly executed invoice for these services or a letter from the manufacturer.

3.10 TESTING

A. Test Conditions. Use field startup and testing procedures submitted in accordance with paragraph 1.07H of this Section and accepted by the Owner’s Representative and the Architect/Engineer. Place circuits and equipment into service under normal conditions, collectively and separately, as necessary to determine satisfactory operation. Perform specified tests in the presence of the Owner's Representative. Furnish instruments, wiring, equipment and personnel required for conducting tests. Demonstrate that the equipment operates in accordance with requirements of the Drawings and specifications. Special tests on certain items, when required, are specified in the individual specification Sections. Where testing is specified or otherwise required to be performed by an independent testing company, use an Owner-approved NETA-certified testing company.

B. Test Dates. Schedule final acceptance tests sufficiently in advance of the contract completion date to permit adjustment and alterations within the number of days allotted for completion of the contract. Inform the Owner’s Representative in advance of test dates in accordance with the applicable requirements of Division One and the General Conditions. Where not specified, required, or directed otherwise, allow a minimum of at least 10 working days advance notice.

C. Retests. Conduct retests as directed by the Owner’s Representative of such time duration as may be necessary to assure proper functioning of adjusted or altered parts or items of equipment. Delays resulting from retests do not relieve the Contractor of his responsibility under this contract.

D. Commissioning. Coordinate with commissioning agent, as applicable, for field testing and commissioning of electrical components and systems.
E. Test Reports. Submit copies of test reports to the Architect/Engineer in accordance with Division One requirements.

3.11 OPERATING AND MAINTENANCE MANUALS

A. General. The Contractor shall provide, in loose-leaf binders, complete operating and maintenance data of each manufactured item of equipment used in the electrical work at least four weeks before Architect/Engineer’s final review and observation of the project. Descriptive data and printed installation, operating and maintenance instructions for each item of equipment will be included. A complete double index will be provided as follows.

B. Format and content. The Operating and Maintenance Manual will be submitted in quantities and format as specified under Division One for Submittals. Provide quadruplicate where quantity is not specified. Operating and Maintenance Manual shall include:
1. Descriptive data of each system and piece of equipment, including ratings, capacity, performance data, operating curves and characteristics, and wiring diagrams.
2. Full detailed spare parts list, including source of supply for each piece of equipment.
3. Printed instructions describing installation, operation, service, maintenance, and repair of each piece of equipment.
4. Typewritten test reports of tests made of materials, equipment and systems under this Division. Test reports will include the dates of the tests, name of person conducting and witnessing the tests, and record of conditions relative to the tests.
5. Copies of “Reviewed” shop drawings and submittals.
6. Print copies of the record Drawings. Refer to paragraph 1.07I of this Section.

END OF SECTION
SECTION 26 0001

ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical demolition.

1.2 RELATED WORK

A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for electrical demolition.
   1. Division 01.
   2. Division 22, Plumbing.
   3. Division 23, Heating, Ventilating, and Air Conditioning.

B. In the event of conflict regarding minor electrical demolition requirements between this Section and other Sections, the provisions of this Section shall govern.

1.3 EXISTING FACILITIES

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in service maintenance of electrical services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing temporary protection upon completion of the work.

B. Provide temporary or new services to existing facilities to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project. See plans for complete requirements.

C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, luminaires, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, remove and reinstall in locations approved by the Architect/Engineer the devices required for the operation of the various systems installed in the existing construction. This is to include but is not limited to temperature controls, system devices, electrical switches, relays, luminaires, fixtures, piping, conduit, raceway, etc.

E. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner 21 working days in order to schedule required
outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. Costs of outages, including overtime charges, shall be included in the contract amount.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for Patching and Extending Work: As specified in individual Sections.

B. Provide materials necessary for work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Demolition and modifications to existing systems shall be coordinated through Owner’s Representative. Demolition drawings are based on casual field observation and existing record documentation; therefore the accuracy or exactness of the drawings is not guaranteed. The Contractor shall verify that field measurements and circuiting arrangements are as shown on Drawings and abandoned wiring and equipment serve only abandoned facilities. The Contractor shall be responsible for reporting discrepancies to the Architect/Engineer and the Owner’s Representative before disturbing existing installation.

B. Beginning of demolition means Contractor accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal. Provide temporary wiring and connections to maintain remaining systems in service during demolition and/or modification as detailed on plans. Owner reserves the right up to 24 hours prior to scheduled event to delay or suspend shutdowns or outages to more convenient times at no additional cost.

B. Existing Electrical Service: Existing service shall be removed after temporary service is operational.

C. Existing Fire Alarm System: Maintain existing system in service in selected areas as detailed in plans. Disable system only to make switchovers and connections. Notify Owner at least 21 working days before partially or completely disabling system. Schedule work so as to minimize outage duration. Provisions for manual fire watch shall be provided in areas where services are interrupted. Areas to remain in operation are clearly noted on the plans. The contractor shall be responsible for relocating/adding any new power supplies, transponder panels etc. to keep the selected areas in operation. Any devices that are relocated or added shall be installed in locations unaffected by demolition. The fire alarm system shall continue to report its alarms via dialer to offsite monitoring. The contractor is responsible for any additional conduit and wiring required to keep the fire alarm system operational.

D. Existing Telephone and Voice/Data Communications System: See Telecom plans.
3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate work as indicated on plan drawings. Unless otherwise noted, remove electrical materials and equipment from areas indicated for demolition. Removal of equipment shall not interfere with existing operations.

B. Remove all electrical devices, conduit and wire in the demolition areas. The exception to this is that conduit serving areas that will remain in operation shall be reused where possible for temporary power.

C. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

D. Extend existing installations using materials and methods compatible with existing electrical installation, structure, and finishes, or as specified.

E. Where existing circuits serving areas to remain extend through areas indicated for demolition, maintain those existing circuits and devices in operating condition. Coordinate outages and interruptions of existing circuits with Owner to minimize interruption of ongoing operations and instruction. Provide raceway and supports to reconnect existing circuits to remain. Promptly reconnect and restore circuits following outages and interruptions.

3.4 CLEANING AND REPAIR

A. The Contractor shall follow the requirements of the General and Supplementary Conditions, Division 01, including Owner’s clean work policy, and shall include the removal of trash and demolished material from the building or work area at the end of each day and removal from the site once a week.

B. The Contractor shall be responsible for repairing adjacent construction and finishes damaged during demolition and/or modification. The Contractor shall be responsible for the removal of ceiling tiles required in the demolition work. The Contractor shall be responsible for the replacement of damaged tiles and reinstallation of the ceiling prior to final acceptance.

3.5 DISPOSITION OF MATERIAL AND EQUIPMENT

A. Review with Owner the materials that have been removed and are no longer required, to determine which materials the Owner may desire to keep. Deliver those materials that the Owner desires to the Owner’s specified location.

B. For those materials not required by the Owner, dispose of them in accordance with applicable regulations.

C. Materials and equipment to be removed, except items specifically listed to be relocated or delivered to the Owner, become the property of the Contractor and shall be immediately removed from the project site.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the furnishing and installation of insulated conductors.

1.2 REFERENCE STANDARDS

A. AEIC No. 6 - Specifications for Ethylene-Propylene-Rubber-Insulated Power Cables 5,000 to 35,000 Volts.


C. ANSI/UL 83 - Thermoplastic-Insulated Wires and Cables.

D. ANSI/UL 1072 - Medium-Voltage Power Cables.

E. IEEE No. 48 - Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminations.

F. ICEA S-61-402 (NEMA WC 5) - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

G. ICEA S-68-516 (NEMA WC 8) - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

H. ANSI/UL 2196 "Tests for Fire Resistive Cables"

I. CSA C22.2 #124

J. UL Fire Resistance Directory

1.3 SUBMITTALS

A. Provide product data on the following:

1. 600-volt conductor, splicing and terminating materials.
PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Provide new insulated conductors marked according to NEC Article 310.

2.2 600-VOLT INSULATED CONDUCTORS

A. Size. As shown on the drawings.

B. Construction.
   1. Conductor. Soft-drawn, annealed copper. Solid for #12 and #10 and Stranded for all other sizes.
   2. Insulation. Unless otherwise noted on the drawings, use THHN/THWN-2 for general wiring. Use XHHW/XHHW-2 for conductors installed below grade.

C. Use. For general wiring use No. 12 minimum. For field-installed control wiring use No. 14 or larger stranded conductors.

D. Listing. Single Conductor. UL 83.

2.3 TYPE MI – MINERAL INSULATED CABLE

A. Size as shown on drawings

B. Construction
   1. Conductor: Solid high conductivity copper
   2. Insulation: 600V, magnesium oxide
   3. Fire Rating: Complex cable system shall have a 2 hour fire rating as used and classified by Underwriters Laboratories, Inc.

C. Manufacturer: Pentair/Pyrotenax

PART 3 - EXECUTION

3.1 INSTALLATION

A. Protection. Unless otherwise indicated, mechanically protect conductors for systems by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Use Polywater J cable lubricant when pulling conductors. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of 600-volt insulated conductors, or less than twelve times the outer diameter of the completed 15 kV cable. Do not exceed manufacturer's recommended values for maximum pulling tension.
B. Splices and Terminations. Use pressure-type lugs or connectors for terminations or splices of all stranded conductors. Use ring-tongue type terminators on all control wiring. Below grade terminations shall be waterproof.

C. Appearance. Neatly and securely bundle or cable all conductors in an enclosure using nylon straps with a locking hub or head on one end and a taper on the other.

3.2 600-VOLT INSULATED CONDUCTORS

A. Size. Install conductor sizes as indicated.

B. Home Runs. Provide branch circuit homeruns as indicated on plans. Homerun designations are indicated on Sheet E-001. Provide the number of homeruns as indicated on plans. A maximum of 6 phase conductors may be installed in one conduit. Include a separate neutral conductor with each phase conductor for all 120V and 277V circuits. Common neutrals are not permitted. Use home run circuit numbers as indicated for panelboard connections. For isolated ground circuits provide an additional ground conductor as indicated on the panel schedules. Provide No. 10 AWG conductor for the entire circuit length for single-phase, 20 ampere circuits for which the distance from panelboard to the last outlet is more than 100 feet for 120 volt circuits and 200 feet for 277 volt circuits.

C. Color Code. Use factory-colored insulated conductors for No. 10 and smaller conductors and color code larger insulated conductors with an approved field-applied tape. Use different colors for control wiring. Follow the color scheme below.

<table>
<thead>
<tr>
<th>Line</th>
<th>208/120</th>
<th>480/277</th>
</tr>
</thead>
<tbody>
<tr>
<td>A or L1</td>
<td>Black</td>
<td>Brown</td>
</tr>
<tr>
<td>B or L2</td>
<td>Red</td>
<td>Orange</td>
</tr>
<tr>
<td>C or L3</td>
<td>Blue</td>
<td>Yellow</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
<td>White</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
<td>Gray/Green</td>
</tr>
<tr>
<td>Switch Leg</td>
<td>Pink</td>
<td>Pink</td>
</tr>
</tbody>
</table>

Where more than one conductor of the same phase or more than one neutral conductor occur at the same outlet or junction box, these conductors shall be identifiable from each other by use of stripes or distinguishing markings. All wiring associated with isolated ground receptacles (line, neutral, ground) shall have a yellow tracer on each conductor.

D. Field Testing. Insulation resistance of all conductors shall be tested. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps and connections are made except connection to or into its source and point (or points) of termination. Insulation resistance of conductors which are to operate at 600 volts or less shall be tested by using a Biddle Megger of not less than 1000 volts d-c. Insulation resistance of conductors rated at 600 volts shall be free of shorts and grounds and have a minimum resistance phase-to-phase and phase-to-ground of at least 10 megohms. Conductors that do not exceed insulation resistance values listed above shall be removed at Contractor's expense and replaced and test repeated. The Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed, and shall forward copies of the test readings to the Owner in accordance with Section 26 0500. These test reports shall identify each
conductor tested, date and time of test and weather conditions. Each test shall be signed by the party making the test.

3.3 TYPE MI – MINERAL INSULATED CABLE

A. Size – Install conductor sizes as indicated.

B. Home runs: Install cable per manufacturer’s instructions

C. Color Code/label: Label each individual cable every 5’ with the following: 600V 2HR fire rated cable.

END OF SECTION
PART 1 - GENERAL

1.1 WORK INCLUDED

   A. This section specifies the furnishing and installing of grounding and bonding equipment for electrical systems.

1.2 REFERENCE STANDARDS

   B. ANSI/TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
   C. ANSI/UL 467 - Grounding and Bonding Equipment.
   F. NFPA 70 - National Electrical Code (NEC).

1.3 RELATED WORK

   A. Division 27, Communications.
   B. Division 28, Electronic Safety and Security.

1.4 SUBMITTALS

   A. Product Data. Submit product data sheets, including complete descriptive information on materials and installation methods.
   B. Approvals: Secure formal approval of shop drawings and product data prior to ordering material. Secure approvals in sufficient time to allow installation of concealed system components without delaying the project.
   C. As-Built Record Drawings. The Contractor shall maintain a master set of As Built record drawings that shows changes and deviations from the Drawings, in accordance with Division
One requirements and Section 26 0000. Deliver As-Built record drawings to Owner upon Owner acceptance of project. Where not specified otherwise in Division 1 or the General and Supplementary Conditions of the construction contract, deliver one set of As-Built record drawings plotted full-scale on mylar with permanent ink, prepared to 1/8-inch scale with 1/8-inch text. Also deliver one set of As-Built record drawings on CD-Rom or similar electronic media acceptable to the Owner. Drawing files shall be in AutoCAD (.dwg) and Adobe Acrobat (.pdf).

PART 2 - PRODUCTS

2.1 CONNECTIONS

A. Materials. Unless otherwise noted, provide exothermic welded type grounding connections for bonds and connections made below grade, embedded in structure, or otherwise concealed. For above grade connections not embedded in structure or otherwise concealed, provide mechanical bolted-type connections utilizing high-conductive copper alloy or bronze lugs or clamps. Where required, provide plated connectors which will not cause electrolytic action between the conductor and the connector.

B. Listing. UL 467.

2.2 CONDUCTORS

A. Materials. Provide grounding conductors fabricated from annealed copper with conductivity ≥ 98 percent IACS conductivity.
   1. Use solid conductor for No. 12 and No. 10 AWG.
   2. Use stranded conductor for No. 8 AWG and larger.
   3. Use stranded conductor for applications subject to continuous vibration, such as engine generators and terminations at motors.
   4. Use stranded, tinned, annealed copper cable for #2 AWG or larger installed inside the building or structure.

B. Insulation. Where insulated grounding conductors are specified or required, provide green-colored 600-volt rated insulation, type XHHW, THWN, or RHW. Insulation type shall be compatible with associated power and lighting system conductors.

C. Location and Application.
   1. Inside building or structure. Provide insulated copper grounding conductors, except where bare copper grounding conductors are indicated on Drawings or specified in this or other Sections.
   2. Bonding jumpers. Use bare copper conductor.

D. Listing. UL 83.

2.3 GROUND BUS

A. Where a field-provided ground bus-bar is required or indicated, provide bus-bar drilled and tapped with double-lug terminations for the quantity of ground connections indicated on the Drawings plus 25% spare capacity, wall-mounted on insulated supports. Use round-edge copper bar with ≥ 98 percent International Annealed Copper Standard (IACS) conductivity. Size the bus-
bar for not less than 25 percent of the aggregated cross-sectional area of the related feeders. A minimum cross-sectional size of 1/4 inch by 2 inches is required; where ground bus-bar of larger dimensions is indicated on plans or specifications provide the bus-bar with the larger dimensions. See E 2.4B for chemical ground rod measurements in test well.

PART 3 - EXECUTION

3.1 GENERAL

A. Install grounding system in accordance with the requirements of the National Electrical Code (NEC), Article 250, and other applicable codes and standards. Coordinate installation of grounding and lightning protection system components with structural and civil work and placement of building structural mat.

B. Install grounding conductors continuous, without splice or connection, between equipment and grounding electrodes. Connection to ground busbars is permitted as an exception to the restriction against splices in grounding conductors. Grounding conductors shall be as short and straight as possible, and protected from mechanical damage.

C. Connect grounding electrode conductors to metal water pipe using suitable ground clamp, where metal water pipe is available and accessible and not protected by an insulating anti-corrosion covering. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter. The grounding electrode conductor shall not be spliced.

D. Install fusion welded (exothermic) grounding connectors where they are below grade, concealed, or inaccessible. Above grade at accessible locations, use copper or bronze lugs and clamps. Grounding and lightning protection system connections made in conjunction with placement of the building structural mat shall be exothermic ground connectors.

E. Strap grounding clamps shall not be used. Connections requiring bolting shall be made up with Monel metal bolts, washers and nuts. Connections shall be made only after surfaces have been cleaned, or ground to expose virgin metal.

F. Conductor connections shall be made by means of solderless connectors such as serrated bolted clamps or split bolt and nut type connectors.

3.2 EQUIPMENT GROUND

A. Raceway Systems and Equipment Enclosures.
   1. Bond cabinets, cable trays, junction boxes, outlet boxes, motors, controllers, raceways, fittings, switchgear, switchboards, panelboards, transformer enclosures, other electrical equipment and metallic enclosures. Bond equipment and enclosures to the continuous-grounded, metallic raceway system in addition to other specific grounding shown. Ground each outlet by the use of an approved grounding clip attached to the outlet box in such a position to be readily inspected upon removal of the cover plate, or by the use of an approved grounding yoke type receptacle.
   2. Provide bonding jumpers and grounding conductors throughout the raceway system to ensure electrical continuity of the grounding system and the raceway.
3. Provide grounding-type insulated bushings for metal conduits 1-1/2 inches and larger terminating in equipment enclosures containing a ground bus. Connect the bushing to the ground bus in the equipment enclosure.

4. Provide a green insulated equipment grounding conductor for each feeder and branch circuit. Terminate each end of grounding conductor on a grounding lug, bus, or bushing.

5. Provide internal grounding conductor on liquid tight flexible metal conduit ("sealtite") with ground bushings.

6. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

B. Size. Where grounding and bonding conductors are not sized on Drawings, size the grounding conductors in accordance with NEC Table 250.122. Size bonding jumper so that minimum cross-sectional area is greater than or equal to that of the equivalent grounding conductor as determined from NEC Table 250.122.

C. Taps, Splices and Connections: Make grounding (earth) conductor approximately 2 inches longer than the ungrounded (phase) conductors at both ends.

3.3 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.4 CONFLICTS

A. In the event a conflict exists between this specification and the referenced standards, the requirements of this specification shall be regarded as secondary and the necessary variances made in order to obtain a UL Master label for the lightning protection system.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
   A. This Section specifies the furnishing and installation of metal framing, including channels, fittings, clamps, hardware, electrical accessories and brackets.

1.2 SUBMITTALS
   A. None required.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Make channels, fittings, clamps, electrical accessories and brackets of sheet steel or of malleable cast iron. Fabricate threaded fasteners of carbon steel.

2.2 COATINGS
   A. Hot-dip galvanize all steel components utilized indoors. Provide stainless steel framing for outdoor applications.

2.3 SIZES
   A. Provide channels fabricated from not less than 12-gage sheet steel, 1-5/8 inches wide and not less than 1-5/8 inches deep.

PART 3 - EXECUTION

3.1 APPLICATION
   A. Hot-dip galvanized steel shall be used in all areas except use stainless steel components when exposed to the weather, in the crawl space and when located in a corrosive atmosphere.
3.2 SUPPORTS
   A. Provide metal framing to support large or heavy wall-mounted equipment, wall-mounted raceways and ceiling-hung raceways. Use stainless steel channel to mount the exhaust fan disconnect switches on the roof. Supports shall be mounted independent of the fan enclosure. Secure support to roof.

3.3 ANCHOR BOLTS
   A. Use 1/2 inch diameter by 3 inches long expansion bolts to attach framing to concrete. Space bolts a maximum of 24 inches on center, with not less than two bolts per piece of framing.

3.4 TOUCH-UP
   A. Touch up all scratches or cuts on steel components with an approved zinc chromate or a 90 percent based zinc paint.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the furnishing and installation of electrical raceway systems.

1.2 REFERENCE STANDARDS

A. ANSI/ANSI C80.1 - Rigid Steel Conduit - Zinc-Coated.
B. ANSI/ANSI C80.3 - Electrical Metallic Tubing - Zinc-Coated.
C. ANSI/UL 1 - Flexible Metal Conduit.
D. ANSI/UL 5 - Surface Metal Raceways and Fittings.
E. ANSI/UL 360 - Liquid-tight Flexible Steel Conduit.
F. ANSI/UL 467 - Electrical Grounding and Bonding Equipment.
G. ANSI/UL 651 - Schedule 40 and 80 Rigid PVC Conduit.
H. ANSI/UL 797 - Electrical Metallic Tubing.
I. ANSI/UL 870 - Wireways, Auxiliary Gutters and Associated Fittings.
J. NEMA VE 1 - Metallic Cable Tray Systems.
K. NEMA TC-6 and 8 – EB Underground Conduit
L. UL 6 - Rigid Metal Conduit.

1.3 SUBMITTALS

A. Surface metal raceways and fittings.
B. Provide product data on cable tray and fittings.
2.1 CONDUIT AND FITTINGS

A. Rigid Metal Conduit.
   2. Fittings. Threaded steel or malleable iron, either cadmium plated or hot-dipped galvanized.

B. Electrical Metallic Tubing (EMT).
   2. Fittings. Steel compression type, either cadmium plated or hot-dipped galvanized.
      Connectors shall have insulated throat bushings.

C. Rigid Nonmetallic Conduit.
   2. Fittings. Solvent weld socket type.

D. Flexible Metal Conduit.
   2. Fittings. One-screw and two-screw for 1-1/2 inches and larger, double-clamp steel or malleable iron, either cadmium plated or hot-dipped galvanized.

E. Liquid-tight Flexible Steel Conduit.
   1. Conduit. Spiral-wound, square-locked, hot-dipped galvanized steel strip plus a bonded outer jacket of PVC.
   2. Fittings. Compression type, malleable iron, with insulated throat, either cadmium plated or hot-dipped galvanized.

F. Elbows.
   1. Provide large radius elbows.

2.2 WIREWAYS

A. Material. Not less than 16-gage sheet steel.

B. Dimensions. Cross section dimensions not less than 4 inches by 4 inches.

C. Finish. Not less than two coats of enamel over a rust-inhibiting prime coat.

D. Type.
   1. Indoors. NEMA 1.
   2. Outdoors. NEMA 4X.

2.3 SURFACE RACEWAYS AND FITTINGS

A. Provide two compartment aluminum raceway for power and data. See plans for specifications.
2.4 CABLE TRAY AND FITTINGS

A. Cable tray shall be 18" wide by 6" deep, B-Line series WB618 or equal.

B. Tray: NEMA VE 1/CSA E22.2 No. 126.1.

C. Material and Finish of Tray, Fittings, and Accessories: Electroplated yellow zinc dichromate per ASTM B633 SC2.

D. Inside radii of fittings: as indicated on Telecom Drawings

E. Accessories and Fittings: Manufacturer's standard clamps, tees, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

F. Warning signs for cable trays:
   1. 1/2-inch high black letters on yellow plastic with the following wording: “WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!”

PART 3 - EXECUTION

3.1 CONDUIT AND FITTINGS

A. Minimum Trade Size. 3/4 inch, except that 1/2-inch flexible metal conduit may be used in lengths not exceeding 72 inches for tap conductors supplying lighting fixtures.

B. Types According to Use.
   1. Use hot dipped galvanized rigid steel conduit (RGS) outside above ground where exposed to weather.
   2. Use EMT in interior walls or ceiling spaces and where exposed in open work areas, mechanical rooms or electrical rooms. Conduit that enters or leaves the top of panelboards or enclosures may be EMT, provided such panelboards and enclosures are located in mechanical or electrical rooms.
   3. Conduits may not be embedded in slabs without approval of the owner and the structural engineer.
   4. Use rigid nonmetallic conduit (Type EB) encased in concrete with minimum 3-inch-thick walls, where installed below grade. Concrete encasement may be omitted when conduit is used for site lighting circuits. In these cases use Schedule 40 PVC. All horizontal to vertical transitions shall be made using RGS elbows RGS conduit stub-ups. Seal all conduits weather tight.
   5. Connect all indoor electrical equipment subject to vibration or movement with flexible metal conduit 24 inches minimum length. Where the equipment is located in a duct or plenum used for environmental air, the length of conduit shall not exceed 4 feet and the conduit shall be flexible metal conduit. Where the equipment is located outdoors or exposed to water, liquid-tight flexible metal conduit shall be used.
   6. Transitions.
      a. Continue the heavier, more protective type conduit application not less than 4 inches into the area where lighter, less protective type conduit is permitted.
      b. For below-grade to above-grade outdoor locations, extend concrete encasement around conduit 4 inches above finished grade and slope top away from conduit with a 6-inch-per-foot slope.
c. For below-grade to above-grade locations using PVC to metal conduit, make the transition from PVC to metal conduit before turning up with RGS elbow.

C. Preparation. Place sleeves in walls and floor slabs for the free passage of cables or conduits. Set sleeves in place a sufficient time ahead of concrete placement so as not to delay the work. Seal all openings and voids around sleeves through floors and walls. Be sure that plugs or caps are installed before concrete placement begins.

D. Installation Requirements.
1. Metallic conduits must be continuous between enclosures such as outlet, junction and pull boxes, panels, cabinets, motor control centers, etc. The conduit must enter and be secured to enclosures so that each system is electrically continuous throughout. Where knockouts are used, provide double locknuts, one on each side. For EMT terminations, provide insulated throat bushings and on rigid metallic conduits, provide nonmetallic insulating bushings for conductor protection. Where feeder conduits, 1-1/2 inches and larger, terminate in equipment having a ground bus, such as in switchgear, motor control centers and panelboards, provide conduit with an insulated grounding bushing and extend a suitable grounding wire to the ground bus.
2. Have rigid nonmetallic conduit adequately solvent welded at joints to form a tight, waterproof connection.
3. Run concealed conduit as directly and with the largest radius bends as possible. Run exposed conduit parallel or at right angles to building or other construction lines in a neat and orderly manner. Conceal conduit in finished areas. Unless otherwise shown, remaining conduit may be exposed. Provide chrome-plated floor and ceiling plates around conduits exposed to view and passing through walls, floors, partitions, or ceilings in finished areas. Select properly sized plates to fit the conduit when securely locked in place.
4. Horizontal run conduits within new walls are not acceptable.

E. Installation Methods.
1. Install each entire conduit system complete before pulling in any conductors. Clean the interior of every run of conduit before pulling in conductors to guard against obstructions and conduit omissions.
2. Cut all joints square, then thread and ream smooth. Coat cuts, threads or scratches on steel conduit with an approved zinc chromate or with a 90 percent based zinc paint. When dry, draw up tight.
3. Make bends with minimum 24” radius. Make field bends using equipment designed for the particular conduit material and size involved. Bends must be free from dents or flattening. Use no more than the equivalent of four 90-degree bends in any run between terminals and cabinets, or between outlet and junction boxes or pull boxes.
4. Conduit bodies may be used in lieu of conduit ells where ease of installation and appearance warrants their use. Conduit bodies larger than 1 inch may be used only where approved.
5. Securely fasten and support conduit to structure or metal framing using hot-dipped galvanized, malleable iron pipe straps or other approved means. Wires of any type may not be used for securing conduits. Branch circuit raceways which are 1 inch or smaller may be attached to wall studs by use of manufactured clips.
6. Provide a No. 30 nylon pulling line in conduits in which wiring is not installed under this work. Identify both ends of the line by means of labels or tags reading “Pulling Line - Telephone,” etc.
7. Suitably cap conduit during construction to avoid water, dirt and trash entrance.
8. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.
9. Use expansion fittings in conduit that terminates at sensitive equipment.
10. With a coupling, terminate concealed conduit for future use at structural surfaces. Install a pipe plug flush with the surface.
11. Openings around electrical penetrations of fire-resistance rated walls, partitions, floors or ceilings shall be firestopped to maintain the fire resistance rating using approved methods.

3.2 WIREWAYS

A. Install wireways, where shown, according to NEC Article 376. Field apply a 90 percent zinc paint coating over cuts or scratches before any other finish is applied.

3.3 SURFACE RACEWAYS

A. Install surface raceways, where shown, according to NEC Article 300. Securely ground raceway and fittings. Provide bushings at raceway entrances. Raceways shall be two compartment, top for receptacles and bottom for data. Provide power conduit and wiring as shown on plans. Provide 1-1 ¼” conduit from data compartment to cable tray. Conduit shall terminate in a flush mounted box at surface raceway location. Provide a 2” nipple between the box and the back of the surface raceway.

3.4 CABLE TRAY

A. Install in conformance with NEC and NEMA requirements and in accordance with manufacturer’s instructions. Arrange cable tray to maintain headroom and present neat appearance. Cables shall be arranged in cable trays in a neat, workmanlike manner.

B. All cable tray cuts/modifications shall be done with manufacturer approved cutters.

C. Support cable tray a minimum of every 5’ on center with manufacturer provided trapeze support kit. Kit shall be a B-Line Model WB5518 for use with 3/8” all thread rod. Provide all accessories necessary for a complete installation. Support cable tray at each connection point, at the end of each run, and at other points to maintain spacing between supports of 5 feet maximum. Trays shall be level.

D. Contactor shall utilize manufacturer’s standard components. Where standard components are not available, modifications shall be per manufacturer’s instructions/specifications.

E. Provide a continuous solid barrier that is electrically continuous installed in all sections of the cable tray. The purpose of the barrier is to separate AV cables from telecom cables. Place the barrier such that ¼ of the tray will be for AC cabling and ¾ of the tray will be for telecom cables.

F. Where it is necessary to make field changes in the tray system, all changes shall be made per manufacturers recommendations.

G. Maintain twelve-inch clearance between cable tray and surfaces with temperatures exceeding 104 degrees F, such as flues, steam pipes, and heating appliances. Maintain at least 4-inch
clearance between cable tray and piping, ductwork or other interference. Any deviation from this must be approved by the Owner. It shall be the Contractor's responsibility to protect existing cable tray in the area of construction against damage throughout the construction period. Any damaged cable tray shall be replaced by the Contractor at no additional cost prior to final acceptance by the Owner.

H. All communication cable trays shall have a continuous, No. 6, green insulated copper grounding conductor run inside the tray. Connect to tray at each fitting or tray section. Connect the tray at each end to the ground bar in the telecom room with #4 AWG. All bonds shall be via exothermic weld. The direction of the welded bond shall be oriented in the correct direction along bonding backbone.

I. Maintain electrical continuity between sections of cable tray using manufacturer provided splice plates and bond cable trays at the both ends to building ground plates to provide a continuous grounding path. Install copper braided bonding jumpers around expansion joints and hinged adjustable splice plates where electrical discontinuity occurs. Install cable trays, where shown, according to NEC Article 392. Install cable trays in accordance with manufacturer's recommendations.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
   A. This Section specifies the furnishing and installation of outlet boxes, floor boxes, junction boxes and pull boxes.

1.2 REFERENCE STANDARDS
   A. ANSI/NEMA Publication No. OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers and Box Supports.
   B. ANSI/UL 514A - Metallic Outlet Boxes.
   C. ANSI/UL 514B - Fittings for Conduit and Outlet Boxes.

1.3 SUBMITTALS
   A. Provide product data.

PART 2 - PRODUCTS

2.1 OUTLET BOXES
   A. Flush Device Boxes. Provide galvanized steel boxes of sufficient size to accommodate wiring devices to be installed at outlet. Provide an extension ring for the device(s) to be installed. Square or rectangular boxes may be used. Unless otherwise noted, provide minimum 2-1/8-inch deep by 4-inch square minimum size box. For data outlets provide minimum 2-1/8-inch deep by 4-11/16 inch square minimum size box.
   B. Exposed or flush Device Boxes. Provide FS or FD cast boxes for surface mounting in areas having exposed rigid metal conduit systems.
   C. Boxes for Lighting Fixtures. Provide galvanized steel octagonal boxes with fixture stud supports and attachments as required to properly support ceiling and bracket-type lighting fixtures. Unless otherwise noted, provide 2-1/8-inch deep by 4-inch box.
   D. Masonry Boxes. Provide galvanized steel, 3-1/2-inch deep, masonry boxes for all devices installed in masonry walls.
2.2 FLOOR BOXES
A. Box. See AV plans.
B. Cover. See AV plans.
C. Location. Specific floor box locations are indicated on the electrical and AV plans.

2.3 JUNCTION, PULL AND SPLICE BOXES
A. Construction. Provide galvanized steel boxes conforming to NEC Article 314.
B. Interior Spaces. Provide NEMA 1 type boxes at least 4 inches deep.
C. Exterior Spaces. Provide NEMA 4X type boxes at least 4 inches deep.
D. Embedded. Provide NEMA 4 cast iron type with flush flanged cover when cast in concrete.
E. Listing. UL 514.

PART 3 - EXECUTION

3.1 OUTLET BOXES
A. Flush Boxes. Unless otherwise indicated, mount all outlet boxes flush within 1/4 inch of the finished wall or ceiling line. Provide galvanized steel extension rings where required to extend the box forward in conformance to NEC requirements. Attach ring with at least two machine screws. Securely fasten outlet boxes. Provide plaster covers for all boxes in plastered walls and ceilings.
B. Fixture Boxes. Where boxes for suspended lighting fixtures are attached to and supported from suspended ceilings, adequately distribute the load over the ceiling support members.
C. Mounting Height. Mounting height of a wall-mounted outlet box means the height from finished floor to horizontal center line of the cover plate. Where outlets are indicated adjacent to each other, mount these outlets in a symmetrical pattern with all tops at the same elevation. Where outlets are indicated adjacent, but with different mounting heights, line up outlets to form a symmetrical vertical pattern on the wall. Verify the final location of each outlet with Owner's representative before rough-in. Remove and relocate any outlet box placed in an unsuitable location.
D. Back-to-Back Boxes. Do not connect outlet boxes back to back unless approval is obtained from the Owner's representative. Where such a connection is necessary to complete a
particular installation, fill the voids around the wire between the boxes with sound insulating material.

E. Box Openings. Provide only the conduit openings necessary to accommodate the conduits at the individual location.

F. When installing electrical boxes in walls and studs, use an electrical box with 2-point adjustable bar hanger bracket similar to RACO steel adjustable bar hanger with 1/2 inch knockout, model #920 or approved equal.

3.2 FLOOR BOXES

A. Verify locations of all floor boxes with the Owner's representative before installation. Completely envelope floor boxes in concrete except at the top. Increase slab thickness at boxes if required to obtain a minimum of 2 inches of concrete below bottom of box. Adjust covers flush with finished floor.

3.3 JUNCTION AND PULL BOXES

A. Installation. Install boxes as required to facilitate cable installation in raceway systems. Provide a junction box for terminating of flexible metal conduit to light fixtures. In general provide boxes in conduit runs of more than 100 feet.

B. Covers. Provide boxes so that covers are readily accessible and easily removable after completion of the installation. Include suitable access doors for boxes above inaccessible ceilings. Select a practical size for each box and cover.


END OF SECTION
SECETION 26 0553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Nameplates and tape labels.
B. Wire and cable markers.
C. Conduit color coding and labeling.

1.2 REFERENCES

A. NFPA 70 – National Electrical Code (NEC).

1.3 SUBMITTALS

A. Provide submittals in accordance with and in additional to Section 26 0000, Electrical General Provisions, and Division 01, for submittal requirements.
   1. Furnish nameplate identification schedules to Owner’s Representative for review and acceptance, listing equipment type and nameplate data with letter sizes and nameplate material.
   2. Nameplate Schedules. Prior to fabrication of nameplates, furnish to Owner for review and acceptance a schedule of nameplates for electrical equipment. For each equipment and circuit identified, provide 4-line nameplate as follows:
      a. Line 1: Device designation, switchgear or MCC cubicle, switchboard circuit, etc. as indicated on plans, schematics, or schedule Drawings.
      b. Line 2: Leave blank for Owner’s use.
      c. Line 3: Source or voltage characteristics, as applicable.
      d. Line 4: Load served.
   3. Refer to Parts 2 and 3 of this Section for nameplate requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Equipment Nameplates:
   1. For normal power electrical equipment, provide engraved three-layer laminated plastic nameplates, engraved white letters on a black background.
   2. For emergency equipment, provide engraved three-layer laminated plastic nameplates with engraved white letters on a red background.
3. For UPS powered equipment, provide engraved three-layer laminated plastic nameplates with engraved white letters on an orange background.

4. For fire alarm system, provide engraved three-layer laminated plastic nameplates with white letters on a yellow background.

5. For security and CCTV system panels, provide engraved three-layer laminated plastic nameplates with white letters on a blue background.

6. Nameplate minimum size shall be 1 inch high by 3 inches long with engraved white letters. Generally, the number and name shall be at least 1/4 inch high and other data at least 1/8 inch high.

B. Conductor Color Tape and Heat Shrink:
   1. Colored vinyl electrical tape shall be applied perpendicular to the long dimension of the cable or conductor.
   2. In applications utilizing tray cable, heat shrinkable tubing shall be used to obtain the proper color coding for the length of the conductor in the cabinet or enclosure. Variations to the cable color coding due to standard types of conductor or cables are not acceptable.

C. Tape Labels: Provide device labels of plastic adhesive tape, with minimum 1/4-inch letters for labeling receptacles, switches, control device stations, junction and pull boxes and manual motor starter units, etc.
   1. Normal power. Black letters on clear background. Provide white letters on black background where specifically indicated on Drawings or specified in other Sections.
   2. Emergency/standby power. Red letters on clear background. Provide white letters on red background where specifically indicated on Drawings or specified in other Sections.
   3. UPS power. Orange letters on clear background. Provide white letters on orange background where specifically indicated on Drawings or specified in other Sections.
   4. Provide device label with black letters, one half inch wide tape with one quarter inch high letters, minimum.
   5. Manufacturer. Brother type “P-Touch”, or accepted substitution.

D. J-Box and Cover plate Voltage Labels: Black stenciled letters 1/4 inch high. Adhesive back tapes may be used if a clear tape is applied over the label for protection.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in individually wrapped factory-fabricated fiberboard-type containers.

B. Store materials in a clean and dry space, elevated above grade, and protected from weather and sunlight.

C. Handle materials carefully to avoid damage, breaking, denting and storing. Damaged materials shall be rejected and shall not be installed.

3.2 INSTALLATION

A. Degrease and clean surfaces to receive nameplates or tape labels.
B. Install nameplates parallel to equipment lines.

C. Secure plastic nameplates to equipment fronts using stainless steel self-tapping screws or rivets. Use of adhesives shall be per Owner’s approval. Stick-on or adhesives will not be allowed unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates. Secure nameplate to outside face of flush mounted panelboard doors in finished locations.

D. Designations: Externally mark equipment, feeders, branch circuits and similar items with nameplates with the same designations as indicated on the Drawings.

3.3 WIRE AND CONDUCTOR IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, ground busbars and at load connection.
   1. Identify with branch circuit or feeder number for power and lighting circuits.
   2. Label control conductor with number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.
   3. Label grounding conductors at ground busbars, electrical equipment, and test wells with metal tags indicating the cable purpose and point of termination at opposite end of cable. Securely fasten metal tags along the length of the grounding cable or conductor. Place metal tags to avoid creating short circuits, inadvertent grounding paths, or other contact with grounded or energized terminals, conductors, or components.

B. Existing Facilities. Where the Contractor encounters conductor identification in existing electrical distribution systems different from the colors scheduled in this Section, notify the Owner’s Representative in writing and propose a resolution, in accordance with the requirements of Part 1 of Section 26 0000, Electrical General Provisions.

C. Conductors for power and lighting circuits shall be identified per the following schedule.

<table>
<thead>
<tr>
<th>Conductor</th>
<th>480/277V</th>
<th>208/120V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A</td>
<td>Brown</td>
<td>Black</td>
</tr>
<tr>
<td>Phase B</td>
<td>Orange</td>
<td>Red</td>
</tr>
<tr>
<td>Phase C</td>
<td>Yellow</td>
<td>Blue</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
<td>White</td>
</tr>
<tr>
<td>Grounding</td>
<td>Gray/Green</td>
<td>Green</td>
</tr>
<tr>
<td>Isolated Ground (IG)</td>
<td>N/A</td>
<td>Green w/Yellow Tracing Stripe</td>
</tr>
</tbody>
</table>

D. Where more than one conductor of the same phase or more than one neutral or ground conductor occurs at the same outlet or junction box, these conductors shall be identifiable from each other by use of stripes or distinguishing markings. The neutral tracer color shall match the phase conductor color with which it is associated.

E. Switch leg conductors. Pink.
   1. The color of switch leg conductors shall be pink, marked with tape matching the color of the associated branch circuit phase conductors.
F. Low voltage wiring systems. Conductors for low voltage circuits shall be identified as follows.
1. Fire Alarm. Red
2. Security. Blue and Yellow. Coordinate wiring color with Division 27 and telecommunications supplier
3. Clock. Green and White
4. Telephone. White. Coordinate wiring color with Division 27 and telecommunications supplier
5. Data. Bright Blue. Coordinate wiring color with Division 27 and telecommunications supplier.
6. HVAC Controls. Dark Blue. Coordinate wiring color with Division 23 and controls supplier.

3.4 NAMEPLATES

A. Provide nameplates of minimum letter height as scheduled below. Nameplates shall be same as equipment names indicated on the Drawings.
1. Externally mark electrical equipment with nameplates identifying each and the equipment served.
2. Supply blank nameplates for spare units and spaces.

B. Nameplate Fasteners. Fasten nameplates to the front of equipment by means of stainless steel self-taping screws. Stick-on or adhesives are not allowed unless the NEMA enclosure rating is compromised, then use only epoxy adhesive to attach nameplates.

C. Provide complete circuit directory for each new panel board. Provide complete circuit directory for each existing panelboard with circuits added, removed, demolished, moved, renovated, or otherwise altered as part of this project or as work required by or incidental to this project. Refer to Section 26 2416 for directory requirements.

D. Identification tags on items in finished areas, such as special switches, etc., shall be securely attached on, or in the immediate vicinity, of the item. Supply blank nameplates for spare units and spaces.

3.5 ENCLOSURE COLOR CODING

A. The following systems shall have each enclosure and cover completely painted as follows:
1. Fire Alarm. Red, with black "FA" text.
2. Emergency Power. Red, with black "E" text.
B. The following systems shall have each junction and pull box cover completely painted per the following:

<table>
<thead>
<tr>
<th>System</th>
<th>Color of Box Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet Backbone</td>
<td>Blue</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Brown</td>
</tr>
<tr>
<td>FCMS</td>
<td>Green</td>
</tr>
<tr>
<td>Emergency Power</td>
<td>Red, with black “E” text</td>
</tr>
<tr>
<td>Security**</td>
<td>White</td>
</tr>
<tr>
<td>Fire Alarm</td>
<td>Red, with black “FA” text</td>
</tr>
<tr>
<td>Clock</td>
<td>Fluorescent Violet</td>
</tr>
</tbody>
</table>

**Security shall include, but not be limited to, the following systems:
- Card Access
- Duress Alarms
- Perimeter Door Alarms

C. CCTV

3.6 EQUIPMENT AND DEVICE MARKING

A. Pull, Junction and Outlet Boxes.
1. With 1/2-inch high permanent lettering, identify conduits connected to pull, junction and outlet boxes with the complete circuit number of the conductors contained therein. Identify complete circuit numbers on box cover and on the conduit.
2. Where multiple circuits are contained in a box, identify the circuit conductors with permanent tags which indicate circuit designation. Identify both phase and associated neutral conductors.
3. Boxes and covers containing emergency power or emergency lighting circuits shall be painted red. Factory finish is acceptable in lieu of painting in the field.
4. Fire alarm boxes and covers shall be painted red. Using permanent black lettering, identify box cover as “F/A” or “FAS”, with fire alarm zone served. Factory finish is acceptable in lieu of painting in the field.

B. Power Receptacles: Use a clear plastic tape label, nameplate or engraved device plate to identify power receptacles where the nominal voltage between a pair of contacts is greater than 150 volts with circuit number, voltage and phases. If nameplates are used, attach to wall directly above device plate. Nominal 120 volt power receptacles shall be labeled with the complete circuit number.

C. Snap Switches:
1. Where the equipment served is not in sight of the snap switch, or where snap switch controls dedicated outlets or special equipment, provide a clear plastic tape label or an engraved switch plate to identify equipment served.
2. Where snap switches are grouped together, provide clear plastic tape labels or engraved switch plates to identify non-lighting equipment served.

D. Dedicated Outlets: For dedicated outlets, provide a clear plastic tape label or an engraved coverplate indicating the equipment served. Dedicated is understood to be specific equipment
listed by equipment number in the panel schedules or identified on the plans. Dedicated also includes computer outlets.

E. Remote Ballasts: For remote ballasts not within five feet of their luminaire, provide appropriate permanent lettering on both the ballasts and the luminaire to identify which units are mated to the other.

END OF SECTION
SECTION 26 2416
PANELBOARDS – DISTRIBUTION AND BRANCH CIRCUIT

PART 1 - GENERAL

1.1 SUMMARY
A. This Section specifies the furnishing and installation of distribution and branch circuit panelboards.

1.2 REFERENCE STANDARDS
A. ANSI/UL 50 - Cabinets and Boxes.
B. ANSI/UL 67 - Electric Panelboards.
C. ANSI/UL 508 - Industrial Control Equipment.
D. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
E. NEMA AB 3 - Molded Case Circuit Breakers and Their Application.
F. NEMA PB 1.1 - General Instructions for Proper Handling, Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.3 SUBMITTALS
A. Provide product data on panelboards and circuit breakers.
B. Provide shop drawings with a schedule for each panelboard that indicates the circuit breaker arrangement and other pertinent features. Panelboard schedules must be identical to the schedules in the project documents unless there is a technical reason for a deviation. Submitted panelboard schedules must also contain confirmation of panelboard characteristics.

PART 2 - PRODUCTS

2.1 ENCLOSURE

A. Cabinet. Construct cabinets in accordance with UL 50. Use not less than 16-gauge galvanized sheet steel. Provide a minimum 4-inch gutter wiring space on each side. Reinforce cabinets and securely support bus bars and over-current devices to prevent vibration and breakage in handling. Provide cabinets without conduit knockouts. All conduit knockouts shall be made in
the field. Surface-mounted panelboards in finished spaces shall have cabinet finishes to match doors and trim as specified below. In unfinished areas such as mechanical and electrical rooms, galvanized sheet steel cabinets are sufficient, provided galvanizing occurs after components are cut or sheared.

B. Doors and Trim. Provide cabinets with single door, dead-front construction. The door shall have a continuous piano hinge on the right side and shall provide access only to circuit breaker operating handles. Removal of trim shall allow for full access to the cabinet interior. Fabricate doors and trim of cold-rolled sheet steel. Equip inner doors with flush-type combination catch and key lock. Key all locks alike. Fasten trim for panelboards to cabinets by an approved means that permits both horizontal and vertical adjustment. Trim for surface-mounted panelboards must fit the cabinet with no overhang. Apply a finish to trim and doors consisting of two coats of enamel over a rust-inhibiting prime coat.

2.2 BUS

A. Fabricate phase, neutral and ground buses of 98 percent IACS conductivity copper with rounded edges. Size bars as indicated and brace them to withstand symmetrical short circuit current as indicated on drawings. Install buses in allotted spaces so that devices can be added without additional machining, drilling or tapping. Use buses with silver-plated contact surfaces. Include copper 200% neutral bus for 208Y/120V panelboards. Provide a ground bus rated as required.

2.3 PROTECTIVE DEVICES

A. Provide circuit breakers for the specified service with the number of poles and ampere ratings indicated.

B. Provide breakers that are quick-make and quick-break on both manual and automatic operation. Use a trip-free breaker that is trip indicating. Incorporate inverse time characteristic by bimetallic overload elements and instantaneous characteristic by magnetic trip. Where indicated, provide ground fault circuit interrupters (GFCI). Main circuit breakers 400A and above in all panelboards shall be 100% rated. Main breakers below 400A and feeder breakers may be 80% rated. Provide electronic trip on the Main breaker, Long time, Short time and instantaneous.

C. For 2-pole and 3-pole breakers, use the common-trip type so that an overload or fault on one pole will trip all poles simultaneously. Handle ties are not acceptable.

D. Unless otherwise indicated on plans, provide circuit breakers with the following interrupting ratings: 35,000 rms symmetrical amperes at rated voltage for breakers rated 277 volts, single pole or 480 volts, multipole and 10,000 rms symmetrical amperes at rated voltage for breakers rated 120V, single pole or 208 volts. Series rating of circuit breakers is not allowed. All circuit breakers shall be fully rated, unless indicated otherwise.

E. Connect breakers to the main bus by means of a solidly bolted connection. Use breakers which are interchangeable, capable of being operated in any position within the panel. Independently mount breakers so that a single unit can be removed from the front of the panel without disturbing or removing main bus, other units or other branch circuit connections.

F. Cable lugs shall suitable for copper or aluminum conductors.
2.4 CIRCUIT IDENTIFICATION
   A. For each panelboard, provide a steel directory frame mounted inside the door with a heat-resistant transparent face and a directory card for identifying the loads served.

2.5 LISTING
   A. UL 67 - Electric Panelboards.

2.6 ACCEPTABLE MANUFACTURERS
   A. Acceptable manufacturers are Eaton Electrical (Cutler-Hammer), Square D, ABB

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install panelboards in the locations shown and as recommended in NEMA PB1.
   B. Surface mounted panels shall be mounted to the wall utilizing 1 5/8" hot dipped galvanized framework. Do not mount panels directly to the wall.

3.2 MOUNTING HEIGHT
   A. Install the panelboards 6’ above finished floor to top of panelboard.

3.3 PROTECTION
   A. Temporary Doors. Protect cabinets by a temporary door until the panelboard is energized. Temporary doors shall be 1/4-inch-thick plywood or equivalent rigid material. Temporary doors shall be installed when the cabinet is installed and shall remain closed at all times except when work is being performed inside the panelboard.
   B. Permanent Doors and Trim. Permanent doors and trim shall be installed immediately before panelboards are energized. Permanent doors and trim shall be maintained in factory condition after installation. Doors shall remain closed at all times except when the panelboard is de-energized and work is taking place within the panelboard.
   C. Cabinets. Cabinet interiors shall be maintained clean at all times. Cabinet exteriors shall be maintained free of mud, spray-on insulation, paint spray and all substances not placed on the exterior surface by the panelboard manufacturer.

END OF SECTION
SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section specifies the furnishing and installation of wiring devices and device plates.

1.2 REFERENCE STANDARDS
   A. Americans with Disabilities Act (ADA).
   D. NEMA WD 1 - General Requirements for Wiring Devices.
   E. NEMA WD 2 - Semiconductor Dimmers for Incandescent Lamps.
   F. NEMA WD 5 - Specific-Purpose Wiring Devices.
   G. NFPA 70 - National Electrical Code (NEC).
   H. Texas Accessibility Standards (TAS).
   I. ANSI/UL 20 - General-Use Snap Switches.
   J. ANSI/UL 498 - Attachment Plugs and Receptacles.
   K. ANSI/UL 943 - Ground Fault Circuit Interrupters.
   L. UL 1449 - Transient Voltage Surge Suppressors.

1.3 RELATED WORK
   A. Section 26 0000, Electrical General Provisions.
   B. Section 26 0537, Boxes.
   C. Section 26 0553, Electrical Identification.
   D. Section 26 5110, Lighting Control System.
   E. Section 26 5100, Interior and Exterior Lighting.
1.4 SUBMITTALS

A. Provide product data on wiring devices and device plates.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide back- and side-wired, industrial-grade, factory-fabricated wiring devices in the type and electrical rating for the service indicated. Where type and grade are not indicated, provide proper selection to correspond with branch circuit wiring and overcurrent protection. Attachment of wires to devices shall be by screw pressure under the head of binding screws or by means of a factory made, listed, plug-style connector. Plug-style connector shall be touch safe while connected to branch circuit conductors and manufactured to mount at 90-degree angle to direction of insertion to allow easy mounting in outlet boxes. Arrangements depending on spring pressure or tension are not acceptable. All binding screws shall be brass or bronze.

B. Grade. Provide industrial-grade devices unless otherwise noted or specified.

C. Type. Provide straight-blade devices as specified herein and as indicated on Drawings. Provide locking-type receptacles (i.e., Twist-Lock) in corridors or other special type receptacles where indicated on Drawings.

2.2 WALL SWITCHES

A. Type. Quiet type, back and side wired switches as shown.

B. Rating. 20 amperes, 120/277 volts, unless indicated or specified otherwise.

C. Finished Areas. Wall switches shall be toggle-style switches. Select device plates of same color, and match with receptacle, phone and data outlet device plate style. Coordinate with Architect and Owner for room finish.


E. Manufacturers. The following designations are for white devices; provide devices in the color specified in paragraph 2.4, this Section.

<table>
<thead>
<tr>
<th>Type</th>
<th>Cooper</th>
<th>Bryant</th>
<th>Pass &amp; Seymour</th>
<th>Hubbell</th>
<th>Leviton</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>1991W</td>
<td>4901W</td>
<td>PS20AC1-W</td>
<td>HBL1221W</td>
<td>1221-2W</td>
</tr>
<tr>
<td>S2</td>
<td>1992W</td>
<td>4902W</td>
<td>PS20AC2-W</td>
<td>HBL1222W</td>
<td>1222-2W</td>
</tr>
<tr>
<td>S3</td>
<td>1993W</td>
<td>4903W</td>
<td>PS20AC3-W</td>
<td>HBL1223W</td>
<td>1223-2W</td>
</tr>
<tr>
<td>S4</td>
<td>1994W</td>
<td>4904W</td>
<td>PS20AC4-W</td>
<td>HBL1224W</td>
<td>1224-2W</td>
</tr>
<tr>
<td>SK</td>
<td>-L</td>
<td>-L</td>
<td>-L</td>
<td>-L</td>
<td>-L</td>
</tr>
</tbody>
</table>

1. Key operated switch: add the indicated suffix to the above designations.
F. Pilot light type shall be equipped with red toggle handle (glow when on), 20 amperes and 120/277 volt AC with number of poles as required.

G. Key operated switches shall be 20 amperes and 120/277 volt AC with number of poles as required. Key locks alike. Furnish keys compatible with key switch, quantity as directed by Owner, minimum of ten copies.

H. Switches for lighting circuits and motor loads under 1/3 hp shall be AC general use snap switch with toggle handle, 20 amperes and 120/277 volt AC with number of poles as required.

I. A listed manual switch having a horsepower rating not less than the rating of the motor, a thermal overload element suitable for the motor served, and marked “Suitable as Motor Disconnect”, shall be permitted to serve as the disconnect means for stationary motors of 1/4 horsepower or less.

J. Use horsepower rated switches, with thermal overload element, approved for motor control or disconnect service when controlling or disconnecting motor loads in excess of 1/4 hp. Horsepower rated switches shall be 30 ampere minimum, with number of poles as required.

K. EPO.
   1. Non-Illuminated 30MM mushroom head EPO switch shall be provided with button guard equal to Schneider Electric #9001K56RM or accepted substitution.

L. Switch terminal screws or connectors shall be designed to accommodate up to No. 10 AWG solid conductor.

2.3 RECEPTACLES

A. Type. Back and side wired receptacles.

B. Rating. As scheduled on Drawings.
   1. Dedicated circuit and convenience duplex receptacles shall be rated 20 amperes, 125 volt AC, where not scheduled or indicated otherwise on Drawings.
   2. Ground Fault Circuit Interrupter (GFCI or GFI). Refer to paragraph 2.3F, this Section.


D. Manufacturers. The following designations are for white devices or manufacturer’s standard device color; provide devices in the color specified in Article 2.4, this Section. Other manufacturers equal in design and function will be considered upon submittal of manufacturer's data.

<table>
<thead>
<tr>
<th>NEMA Config.</th>
<th>Cooper</th>
<th>Bryant</th>
<th>Pass &amp; Seymour</th>
<th>Hubbell</th>
<th>Leviton</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-20R</td>
<td>5362</td>
<td>5362</td>
<td>5362-AW</td>
<td>5362</td>
<td>5362A-W</td>
</tr>
<tr>
<td>GFCI</td>
<td>GF8300</td>
<td>GFR83FT</td>
<td>2094-W</td>
<td>GF-8300</td>
<td>8899-W</td>
</tr>
</tbody>
</table>

E. Heavy Duty Locking-Blade Receptacles. NEMA WD 5. Locking-blade receptacles shall be heavy duty specification grade.

F. Ground Fault Circuit Interrupter (GFCI). GFCI receptacles shall be rated 20 amperes, 125 volt with integral ground fault current interrupter.
   1. End of Life. GFCI receptacles shall include End-of-Life protection, such that when the GFCI device is incapable of passing the internal self-test function, and can therefore no longer
provide ground fault protection, the GFCI receptacle will either render itself incapable of delivering power, or indicate by visual or audible means that the device must be replaced.

2. Reverse Line-Load Miswire. GFCI receptacles shall include reverse line-line protection, such that the GFCI device will deny power to the receptacle face if it is mis-wired with the connections to the line and load terminals reversed.


4. Do not use feed through feature.

5. GFCI receptacles are required throughout the building within 6 feet of sinks, including lab areas.

6. Each GFCI device shall control only one receptacle.

7. Where receptacle is installed in damp or wet locations provide weather resistant type GFCI receptacles.

8. GFCI receptacles shall not use MOV’s in the device to mitigate surge suppression or overvoltage conditions.

G. Specific-use receptacles shall have volts, amps, poles, and NEMA configuration as noted on Drawings.

H. Weatherproof Receptacles. Receptacles specified or indicated as “weatherproof” shall be mounted in a cast steel box with gasketed, weatherproof device plate as specified. Provide weatherproof, gasketed device covers suitable for continuous connection of cord-and-plug devices. See paragraph 2.5E, this Section.

I. Automatic Controlled Receptacle.
   1. All nonlocking-type, 125 volt, 15 and 20 ampere receptacles that are controlled by an automatic control device or incorporate control features that remove power from the outlet for the purpose of energy management or building automation shall be marked with the symbol indicated in paragraph 2.3.1.2 of this Section placed on the controlled receptacle outlet where visible after installation. The receptacles will be controlled via aux contact controlled from the room lighting occupancy sensors.
   2. Receptacle identifier

2.4 DEVICE COLOR

A. Supply wiring devices in ivory, except where device color is specified or scheduled on Drawings or to match existing color, and as noted below:
   1. Wiring devices connected to emergency power shall be red.
   2. Isolated ground receptacles shall be orange.
   3. Key operated switches shall be gray.
   4. Switched receptacles shall be green.

B. Coordinate color of devices and device plates with the architectural finish for that room or area. Refer to architectural Drawings and specifications. Verify color and finish with Architect and Owner’s Representative.

C. For renovation or expansion of existing facilities, provide devices and plates to match existing finishes, devices, and device plates.
2.5 DEVICE PLATES

A. Finished Spaces.
   1. Provide high abuse and impact resistant thermoplastic device plates, with cutouts as required for devices indicated on Drawings. Edges of plates must be flush with edges of boxes. Nylon 66 material plates will not be accepted. Only thermoplastic and polycarbonate are acceptable.

B. Color.
   1. Device plates for receptacles connected to emergency power shall be red.
   2. Device plates for receptacles connected to normal power shall be white.
   3. Where not specified or indicated otherwise, provide device plates in white.

C. Where switches or outlets are shown adjacent to each other, they shall be ganged with partitions between different type services and covered by a single custom wall plate.

D. Jumbo plates are not permitted.

E. Weatherproof enclosures.
   1. For each GFCI receptacle specified in 2.3F and installed in wet locations, provide a weatherproof enclosure cover per NEC 406.9B(1) (Leviton 5977 DGR).

F. Exposed Boxes in Dry Interior Spaces. Make plates of heavy cadmium-plated sheet steel. Edges of plates must be flush with edges of boxes. Screws and fasteners shall be stainless steel.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Deliver wiring devices individually wrapped in factory-fabricated containers.

B. Handle wiring devices carefully to avoid breaking, scoring, and damage to material components, enclosure and finish. Damaged products shall be rejected and not be installed on this project.

C. Store wiring devices in a clean, dry space, elevated above grade, and protected from weather, dirt, sunlight, and moisture.

D. Refer to paragraph 3.2 of Section 26 0000, Electrical General Provisions.

3.2 INSPECTION

A. Examine the areas and conditions under which wiring devices are to be installed and notify the Owner and the Architect/Engineer in writing of conditions detrimental to the proper and timely completion of the work. Include a written plan for correction of deficiencies and conditions noted. Inspect devices for physical damage. Do not proceed with the work until unsatisfactory conditions have been corrected.
3.3 DEVICE COORDINATION

A. Where items of equipment are provided under other Sections, by other Divisions, or by the Owner, provide a compatible receptacle and device plate for the cap or plug, and cord of the equipment.

3.4 GENERAL

A. Install wiring devices in accordance with applicable requirements of the NEC, NEMA, ANSI, and the product manufacturer recommendations.

B. Taps, Splices and Connections. Make grounding (earth) conductor approximately 2 inches longer than the ungrounded (phase) conductors at both ends. Refer to Section 26 0526, Grounding and Bonding.

C. Termination. Stranded conductors for branch circuit wiring to snap switches and receptacles shall terminate at the wiring device with an insulated tin-plated copper spade compression terminal. Select a spade terminal compatible with the wiring devices supplied so that device screw terminals can be torqued to the wiring device manufacturer's recommendations. Refer to Section 26 0519, Insulated Conductors.

D. Where more than one device occurs in one outlet box, such that the voltage between adjacent devices would exceed 300 volts, provide a barrier for isolation to comply with the requirements of NEC Article 404.8(B).

E. Location. The approximate location of switches, power outlets, floor boxes, etc., is indicated on the Drawings. These Drawings, however, may not give complete and accurate information in regard to locations of such items. Determine exact locations by reference to the general building Drawings and by actual measurements during construction of the building before rough in, subject to the approval of the Constructor Inspector and the Owner's Representative.

F. Coordination.
   1. Coordinate location, mounting height, and orientation of wiring devices with adjacent outlets for other systems such as HVAC control, voice/data, security, fire alarm, etc.
   2. Communications Outlets. Where 4-plex receptacles (i.e., double duplex) are indicated or shown on the Drawings in the vicinity of communications outlets for voice, data, and telephone systems provide standard 4-inch by 4-inch recessed wall box flush with finished wall for communications outlet. Space 4-plex receptacle and communications outlet 6 inches horizontally between outside edges of adjacent boxes.
   3. Casework and Millwork. Coordinate devices installed in casework and millwork with the location, finish, and mounting arrangement of the casework and millwork. Review applicable shop drawings and coordinate the installation with applicable Division.
   4. Refer to Section 26 0537, Boxes, for additional requirements.

G. Wiring. Devices must be completely wired and installed. Provide hot, neutral, ground, and other connections of appropriate voltage as required for proper device and luminaire function. Luminaires and lighting controls must be operating properly at final completion.
3.5 RECEPTACLES

A. Location.
   1. Install convenience outlets in a suitable steel outlet box centered at the height of 18 inches above floor, 8 inches above counters or above the backsplash level, or as indicated on the Drawings. Do not install receptacles partially in the backsplash and partially in the wall. Coordinate location with equipment and architectural Drawings.
   2. Position the center of communications outlets (telephone, data, computer and TV) 18 inches above floor or 8 inches above countertops, unless otherwise noted or indicated. Do not install communications outlets partially in the backsplash and partially in the wall. Coordinate with communications (Voice/Data) supplier, architectural Drawings, shop drawings, and millwork.
   3. Install specific-use receptacles at heights shown on Drawings.
   4. Mount receptacles generally where indicated on Drawings. The Owner's Representative reserves the right to make reasonable changes in receptacle locations without change in the contract sum.

B. Position.
   1. Install receptacles vertically with ground pole on bottom. Install receptacles horizontally, where field condition does not allow vertical installation, with ground pole on left.
   2. Where receptacles are located adjacent to wall switches or communication outlets, group devices and mount vertically, or as indicated on Drawings.

C. Type and Grade.
   1. Provide industrial-grade receptacles unless otherwise noted or specified.
   2. Provide locking-type receptacles (i.e., Twist-Lock) in corridors or other special type receptacles where indicated on Drawings.

D. Ground Fault Circuit Interrupter (GFCI). Provide GFCI-type receptacle for receptacles within 6-feet of a water source such as sinks. Connect branch circuit wiring to line-side terminals of GFCI receptacle. Feed through to non-GFCI receptacles is not permitted.

E. Furniture:
   1. Locate boxes serving electrified furniture as indicated on plans.
   2. Refer to Part 3 of Section 26 0537, Boxes.

3.6 WALL SWITCHES

A. Location.
   1. Set wall switches in a suitable outlet box centered at the height of 48 inches from the floor, except as otherwise shown.
   2. Where shown near doors, install switches and dimmers not less than 2 inches and not more than 12 inches from door trim.
   3. Verify door swings before rough in and locate switch on the strike side of the door as finally hung. Where glass wall or glass partition is indicated or provided at strike side of door, install switch on adjacent wall and clear of door swing.
   4. Where wainscot or backsplash occurs at the 48 inches level, install device in the wall above the wainscot or backsplash or as near the 48 inch level as possible to provide the most pleasing appearance. In no case shall the switch be installed partially in the wainscot or backsplash and partially in the wall.
B. Position. Install wall switches in a uniform position so the same direction of operation will open and close the circuits throughout the job, generally up or to the left for the ON position.

3.7 DEVICE PLATES

A. Type. Provide device plates for each outlet of the type required for service and device involved. Plates shall be provided for telecom and A/V per those documents.

B. Ganged Devices. Mount ganged devices under a single, one-piece device plate.

C. Workmanship. Install devices and device plates level, plumb, and parallel to adjacent surfaces or trim. Devices shall be flush with the finished trim cover plates. Device plates shall be tight to surfaces over which they are installed.

D. Patching. Where cover plates do not completely conceal the rough openings for the devices, it shall be the responsibility of the Contractor to patch, paint, etc. around the opening to the satisfaction of the Owner's Representative.

E. Engraving. Engrave plates with 1/8-inch-high black letters, if designated for engraving.

F. Labels. Where switches controlling devices that are out of sight, or where three or more switches are gang mounted, provide plates with labels to identify items being controlled, or areas being lighted. Refer to Section 26 0553 for Electrical Identification requirements.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
   A. This Section specifies the furnishing and installation of low voltage fuses rated 600 volts and below, 6000 amperes and below.

1.2 REFERENCE STANDARDS
   A. ANSI/UL 198E - Class R Fuses.
   B. ANSI/UL 198C - High Interrupting-Capacity Fuses, Current Limiting Types, Class L.
   C. ANSI/NEMA FU 1 - Low Voltage Cartridge Fuses.
   D. ANSI/UL 248 - Fuses.

1.3 RELATED WORK
   A. Section 26 0000, Electrical General Provisions.

1.4 SUBMITTALS
   A. Provide product data on fuses.
   B. Refer to Section 26 0573 for submittal requirements in conjunction with short circuit and overcurrent protective device coordination study.

PART 2 - PRODUCTS

2.1 VOLTAGE
   A. Provide fuses with a voltage rating suitable for the nominal voltage of the system in which they are to be applied.
2.2 TYPES

A. Time Delay Fuses. Unless otherwise indicated, provide UL Class RK-1 time delay, current limiting fuses having 200,000 rms symmetrical amperes interrupting rating. Use on 600-ampere or smaller circuits where indicated.

B. Non-Time Delay Fuses. Fuses indicated by "K 1" on the drawings are UL Class RK 1 non-time delay having 200,000 rms symmetrical amperes interrupting rating. Use on 600-ampere or smaller circuits supplying branch circuit panelboards, resistance heating, and where otherwise indicated.

C. Class L Fuses. Fuses rated 601 to 6000 amperes are UL Class L with 200,000 rms symmetrical amperes interrupting rating.

2.3 MANUFACTURER

A. Bussman.

B. Ferraz Shawmut.

C. Littelfuse.

D. Low voltage fuses must be products of a single manufacturer.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver fuses individually wrapped, in factory-fabricated containers.

B. Store fuses in a clean and dry space and protected from weather, moisture, corrosion and damage.

C. Handle products carefully to avoid damage to material components and finish. Damaged fuses shall be rejected and not be installed on project.

D. Refer to paragraph 3.2 of Section 26 0000, Electrical General Provisions.

3.2 INSTALLATION

A. Instructions. Follow the manufacturer's installation instructions.

B. Fuse Clips. Check fasteners on fuse clips for tightness when installing fuses.

C. Labels. Install fuses so label is in an upright, readable position. Fuses without labels are not acceptable.
3.3 SPARE FUSES

A. As spares, provide the greater amount of either three fuses or 10 percent of each size and type installed. Deliver the spare fuses to the Owner at the time of final acceptance of the project.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. This Section specifies the furnishing and installation of enclosed safety switches. All switches shall be fused.

1.2 REFERENCE STANDARDS
A. ANSI/UL 98 - Enclosed and Dead-Front Switches.
B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches.
C. NFPA 70 - National Electrical Code (NEC).
D. NFPA 70E - Standard for Electrical Safety in the Workplace.

1.3 RELATED WORK
A. Section 26 0000, Electrical General Provisions.
B. Section 26 2813, Fuses - 600 Volt and Below.

1.4 SUBMITTALS
A. Provide product data on each type and rating of switch.
   1. Ratings including voltage, and horsepower or continuous current.
   2. Dimensioned outline drawings.
   3. Conduit entry/exit locations.
   4. Cable terminal sizes.
   5. Wiring diagrams.

PART 2 - PRODUCTS

2.1 CHARACTERISTICS
A. Voltage. Provide switches with a voltage rating of 250 volts d-c, 240 volts or 600 volts a-c, as required for the installed system voltage.

B. Type. Provide switches conforming to NEMA KS 1 standard for Type HD (heavy duty).
C. Contacts. Provide switches with quick-make, quick-break contacts.

D. Poles. Unless otherwise shown, provide 3-pole, visible blade switches.

2.2 CONSTRUCTION

A. Enclosure. Provide NEMA 1 enclosures for switches in indoor dry locations. Provide NEMA 3R enclosures for switches located outside the building conditioned envelope. Provide NEMA 4X stainless steel enclosures for switches located in corrosive environments, unless otherwise shown.

B. Operating Handle. Provide a handle suitable for padlocking in the OFF position with as many as three padlocks of 5/16-inch diameter shank. Use a defeatable, front accessible, coin-proof door interlock to prevent opening the door when the switch is in the ON position and to prevent turning the switch ON when the door is open.

C. Terminal Shield. Provide incoming line terminals with an insulated shield so that no live parts are exposed when the door is open.

D. Neutral. Provide each switch with an isolated, fully rated neutral block. Make provisions for bonding the block to the enclosure.

E. Ground. Provide each switch with a ground lug.

F. Fuse Holders. Provide switches with rejection-type fuse holders which are suitable for use with fuses specified under Section 26 2813, Fuses - 600 Volt and Below. All switches shall be fused.

G. Nameplates. Provide metal nameplates, front cover mounted, which indicate the switch type, catalog number and horsepower rating (with both standard and time delay fuses).

2.3 LISTING


2.4 MANUFACTURER

A. ABB.

B. Square D Company.

C. Eaton/Cutler-Hammer.
PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver products individually wrapped, on pallets or in factory-fabricated fiberboard type containers.

B. Store products in a clean and dry space, elevated above grade, and protected from weather, sunlight, moisture, corrosion, dirt and damage.

C. Handle products carefully to avoid damage to material components, enclosure and finish. Damaged products shall be rejected and not be installed on project.

D. Refer to Paragraph 3.2 of Section 26 0000, Electrical General Provisions.

3.2 INSTALLATION

A. Install safety or disconnect switches where indicated, in accordance with the manufacturer's written instructions, and the applicable requirements of NEC. Install safety and disconnect switches in accordance with the directions of the Owner’s Representative.

B. In general, mount switches and disconnects so that operating handle is approximately 60 inches above finished floor. Where grouped, align tops of switches.

C. For equipment with motors larger than 1/8 hp, provide disconnect switches within sight of the motor.

D. Mount motor and circuit disconnect enclosures, independent of equipment served, on columns or freestanding on a bolted unistrut-type or galvanized welded angle iron framework anchored to floor. Refer to Section 26 0529, Metal Framing and Supports.

E. Switch interiors shall be maintained clean until final acceptance by Owner. Switch exteriors shall be maintained free of mud, spray-on insulation, paint spray and other substances not placed on the exterior surface by the switch manufacturer.

3.3 FUSIBLE DISCONNECT SWITCHES

A. Provide fusible disconnect switches only. Coordinate with Divisions 14, 21, 22, 23, and equipment supplier for warranty and listing requirements of equipment approved by submittal.

B. Install fuses in fusible disconnect switches. Provide permanent marking inside switch enclosure for fuse type and size.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the furnishing and installation of luminaires complete with lamps, ballasts, and other accessories. Provide poles for exterior luminaires requiring such.

1.2 REFERENCE STANDARDS

A. ANSI C78 Series - Lamps.
B. ANSI C82 Series - Ballasts.
C. ANSI/UL 844 - Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.
D. ANSI/UL 1574 - Track Lighting Systems.
F. NFPA 70 - National Electrical Code (NEC).
H. UL 924 - Emergency Lighting and Power Equipment.

1.3 RELATED WORK

A. Section 26 0000, Electrical General Provisions.
B. Section 26 0533, Raceways.
C. Outdoor lighting for state-funded project shall meet “cutoff luminaire” criteria set forth by Texas House Bill 916 (1999).
1.4 SUBMITTALS

A. Submit product data on each luminaire, emergency lighting unit, exit sign, and pole, with separate sheet for each luminaire, assembled by luminaire "type" in alphabetical order, with the proposed luminaire, ballast or Driver, lamps, and accessories clearly labeled. Submit at one time in booklet form.
   1. Include with submittal data dimensioned drawings and performance data including coefficients of utilization, candela distribution, spacing to mounting height ratio, efficiency, efficacy, and visual comfort probability.

B. LED: Provide documentation for performance of LED luminaires including LM 79, LM 80 reports and L70, L80 or L85 test results. Provide documentation for listed tolerances for variation in temperature color, or "binning". Binning documentation shall include MacAdam steps diagram with range of binning clearly indicated. Provide testing data that clearly indicates listed environmental conditions for installation of luminaire including ambient temperature.
   1. LED luminaires with remote drivers shall clearly indicate required wattage and voltage tolerance of driver and maximum range for which driver can be installed remote to LED luminaire.
   2. Provide power requirements for complete LED fixture package clearly indicating the lumen package and power consumption of the entire fixture package.
      a. Data indicating only lumen package and power requirements for individual LED modules incorporated into the complete fixture package is not acceptable.

C. Samples.
   1. When requested in writing by the Owner’s Representative or the Architect/Engineer, furnish samples of luminaire types.
   2. Deliver samples for luminaire types as requested, at a time and place designated by the requestor (Owner’s Representative or the Architect/Engineer).
   3. Samples shall be complete product models as proposed for use on the project.
   4. Furnish samples to the Owner at no additional cost.
      a. Samples shall not be installed on the project without the written consent of the Owner’s Representative and the Architect/Engineer.
      b. Upon written concurrence from the Owner’s Representative, samples furnished for the project may be retained by the Contractor for delivery as “spares” following Owner’s acceptance of the completed project.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Manufacturer. Luminaires are specified by type and manufacturer in the Luminaire Schedule on the Drawings.

2.2 LAMPS

A. General. Provide lamps for luminaires. Types are specified in the Luminaire Schedule on the Drawings.
B. Light Emitting Diodes (LED) or Solid State Lighting
   1. Provide luminaire package with temperature variance limited to three MacAdam steps as defined in ANSI C78.377.
   2. Provide luminaire that is factory tested as a complete package with a LM-79 and LM-80 report.
   3. Provide luminaire with individual LED boards. Replacement of individual LED boards shall be capable to be performed in the field and shall not require replacement of the entire unit or fixture.
   4. Provide fixture with minimum 5 year warranty covering complete luminaire package.
   5. Provide LEDs with phosphorous coating, for creation of white LEDs, at the individual LEDs and not at the luminaire lens or housing.
   6. Provide luminaire with quick disconnect for LED drivers and individual LED boards.
   7. Provide LED fixtures compatible with 0-10V or DALI non-proprietary controls.
   8. Provide LED luminaires with appropriately sized heat sink.

2.3 BALLASTS

A. General. Provide ballasts for luminaires as required and as scheduled.

B. Light Emitting Diode (LED) Drivers
   1. UL Listed as a complete assembly with luminaire,
   2. RoHS and FCC compliant.
   3. Minimum 5 year warranty.
   5. UL Class 2 power limited per UL1310.
   6. UL dry and damp location listed.
   7. Power factor greater than 0.90 and <20% THD.
   8. Driver shall operate at specified input voltage with sustained variation of +/- 10% with no damage to the driver.
   9. Integral surge protective device.
   10. Driver shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
   11. Minimum operating temperature -20C.
   12. Driver output regulated +/- 5% over published load range. Output shall be compatible with LED board in specified luminaire.
   13. Output current controls local to the driver (trimpot or programmable).
   14. If specified on the Drawings, the driver shall dim within the range specified on the fixture schedule with no flicker.
   15. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.

C. Listings.
   1. LED - UL1310 - Class 2 power supplies

D. Fuses. Provide in-line fuses in base of the pole for pole-mounted luminaires.

2.4 EMERGENCY BATTERY PACK/BALLAST

A. Where indicated on luminaire schedule or plans, provide luminaires with emergency ballasts. Emergency ballasts shall automatically provide for a minimum of 90 minutes of illumination in
the event of loss of normal power to the building. Where larger capacity is indicated on plans or schedules, provide unit with larger capacity.

B. Emergency battery packs/ballasts shall comply with the following requirements:
   1. Exceed the NEC, LSC, and UL 90-minute requirements, and carry the UL label.
   2. Contain high-temperatures nickel cadmium batteries that are maintenance free and fully recharge within 24 hours.
   3. Are backed by full (non pro-rata) warranties, 5-years.
   4. Capable of operating one or two lamps, with minimum lumen output as indicated on the Drawings.
   5. Provide self-diagnostics/self-testing with the lighting unit.

C. Manufacturer. Bodine, and the scheduled luminaire manufacturers.

2.5 EMERGENCY LIGHTING UNITS

A. See plans.

B. Where batteries are provided, refer to section 2.4.

2.6 EXIT SIGNS

A. See plans.

B. Where batteries are provided, refer to section 2.4.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Deliver luminaires, exit signs, emergency lighting units, and accessories individually wrapped in factory-fabricated fiberboard type containers.

B. Handle luminaires, exit signs, emergency lighting units, and accessories carefully to prevent breakage, denting and scoring the luminaire finish. Do not install damaged units.

C. Store luminaires, exit signs, emergency lighting units, and accessories in a clean, dry space, elevated above grade, and protected from the weather and sunlight.

D. Refer to paragraph 3.2 of Section 26 0000, Electrical General Provisions.

3.2 COORDINATION

A. Prior to ordering luminaires, check the type of ceilings to be installed in each room and verify that the luminaires are proper and compatible for the type of ceiling as specified and as indicated on the architectural Drawings. Provide a frame compatible with the type of ceiling in which the luminaire is installed. Refer to the Drawings and the Architectural Room Finish...
Schedule for the specified ceiling type. Advise the Owner's Representative of discrepancies before placing the luminaire order.

B. Check the building electrical system requirements and architectural finishes, and regardless of the catalog number prefixes and suffixes shown, furnish luminaires with the proper trim, frames, plaster rings, supports, hangers, stems, mounting brackets, ballasts, voltage rating, and other miscellaneous appurtenances to properly coordinate with said conditions. Verify with Owner's Representative prior to ordering.

C. If a luminaire type designation is omitted, furnish luminaire of the same type as shown for rooms of similar usage. Verify with Owner's Representative before purchase and installation.

D. Examine the areas and conditions which luminaires are to be installed and notify the Owner's Representative and the Architect/Engineer in writing of conditions detrimental to the proper and timely completion of the work. Include written plan for correction of deficiencies and conditions noted. Do not proceed with the work until unsatisfactory conditions have been corrected.

E. Verify that the occupancy sensors are compatible with the specified ceiling systems as indicated on the Drawings. Advise the Architect/Engineer of discrepancies before placing the device order.

F. Coordinate luminaire installation with lighting controls per Section 26 0923, with architectural dimming system per Section 26 0933, and with digital network addressable lighting controls per Section 26 0943.

3.3 INSTALLATION

A. Install luminaires in accordance with the manufacturer's written instructions, Owner's requirements, the applicable requirements of NEC and local and national Codes, Standards, and regulations.

B. Install luminaires at locations as shown on the Drawings, install aligned, aimed, and leveled. Install luminaires in accordance with manufacturer's installation instructions complete with mounting accessories, trim and support materials.

C. Support.
   1. Provide hangers and support members for luminaires as required for proper installation. Provide appurtenances which include stud supports, stems, mounting brackets, frames and plaster rings.
   2. Support luminaires from the building structure or from furring channels. Furring channels must be a minimum size of 1-1/2 inches. Luminaires in suspended ceilings shall be supported in accordance with NEC 410.
   3. Fasten luminaires securely to structural support members of the building. Support grid-type lay-in luminaires from the structure above at each corner of luminaire. 1/4 inch expansion slip ring anchorage with eye and ceiling-type support wire is permitted. Two wires may be supported by one anchorage if required by construction conditions, such as obstructions by other system. Solid pendant luminaires shall be plumb.
   4. Provide support for 1/2 inch pre-manufactured flexible metal conduit (FMC) whips from structure above. Whips shall not touch ceiling system as finally installed. Whips shall be kept 12 inches clear of ceiling except where required for termination at luminaires. Use of "fixture support wire installation" with caddy clip is permitted.
5. Flexible metal conduit from junction box to luminaire shall not touch the ceiling as finally installed.

D. Coordinate with other crafts to avoid conflicts between luminaires, supports, fittings and mechanical equipment.

E. Surface Mounted Luminaires.
   1. Mount with support rails attached to ceiling suspension support system, provided ceiling system has been certified to be suitable to support weight of luminaires.
   2. Where ceiling system has not been certified to support weight of luminaires, luminaires shall be supported at four points near each corner of luminaires.
   3. Provide a minimum 5/8" air space between the luminaires and the ceiling.

F. Recessed Luminaires.
   1. Handle specular/semi-specular louvers and down light cones using only new clean white cotton or silk gloves. Do not touch louvers or cones with bare hands. Leave luminaires clean and free of visible dust, debris, or fingerprints with lamps operational at time of acceptance of work.
   2. Recessed luminaires in lay-in grid shall be supported independently from building structure above ceiling with galvanized steel wire at not less than 4 points near corners of luminaires. Size of wire shall be capable of supporting weight of luminaires. This requirement is separate and apart from hanger wire requirements of the ceiling grid.
   3. Recessed luminaire trims shall fit snugly to the mounting surface and shall not exhibit light leaks or gaps. Provide feed-through junction boxes or provide separate junction boxes. Components shall be accessible through the ceiling opening.

G. Protect installed luminaires from damage during the remainder of the construction period.

H. Luminaires must be completely wired and lamps installed. Luminaires must be operating properly at final completion.

I. Adjustment.
   1. Adjust luminaires to illuminate intended areas as directed.
   2. Adjust exterior luminaires during hours of darkness. Where acceptable to the Owner’s Representative, exterior luminaires may be adjusted during daylight hours; verification of adjustments shall be conducted during hours of darkness.

J. Upon completion of installation of interior luminaires, and after circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

K. Immediately before final observation, clean luminaires, inside and out, including plastics and glassware, and adjust trim to properly fit adjacent surface, replace broken or damaged parts and lamp, and test luminaires for electrical as well as mechanical operation.

L. At Owner’s option, up to 30% of the luminaires shall be opened by the Contractor for inspection. The luminaires may be inspected prior to or after installation. If instant-start ballasts are found, luminaires shall be opened, inspected and the instant start ballasts replaced with approved programmed rapid start ballasts at Contractor’s expense.
3.4 TESTING

A. The Contractor shall demonstrate to the Owner the proper operation of luminaires, systems and equipment specified in this Section and related Sections. The Contractor shall adjust, repair or replace as necessary components that do not perform as specified, until able to demonstrate proper operation of equipment in normal, automatic, manual, emergency, power-loss, and power-restored modes of operation, as applicable.

END OF SECTION
SECTON 26 5110
LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED SECTIONS
A. Section 26 5100 – Interior and Exterior Lighting.
B. Section 23 0900 – Instrumentation and Control for HVAC.

1.2 REFERENCES
B. NEMA - National Electrical Manufacturers Association
C. FCC emission standards
D. UL - Underwriters Laboratories, Inc. Listings
E. UL 20 - General Use Switches.
F. UL 924 - Standard for Emergency Lighting and Power Equipment

1.3 DESIGN / PERFORMANCE REQUIREMENTS
A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
B. System shall conform to requirements of NFPA 70.
C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
D. System shall be listed under UL sections 916 and/or 508.
E. Interface lighting control system with AV system where required. Electrical contractor shall provide all modules, wiring and equipment required for interface with AV system. Coordinate exact requirements with Division 27.
1.4 SUBMITTALS

A. Submit under provisions of Section 01 3000 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   3. Storage and handling requirements and recommendations.
   4. Installation instructions.

C. Shop Drawings: Wiring diagrams for the various components of the System specified including:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
   2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
   3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
   4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
   1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
   2. Operation and Maintenance Manual:
      a. Include approved Shop Drawings and Product Data.
      b. Include Sequence of Operation, identifying operation for each room or space.
      c. Include manufacturer's maintenance information.
      d. Operation and Maintenance Data: Include detailed information on device programming and setup.
      e. Include startup and test reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.
1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:
   1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
   2. Review the specifications for low voltage control wiring and termination.
   3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
   4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:
   1. Record minutes of the conference and provide copies to all parties present.
   2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
   3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.8 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. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
   2. Relative humidity: Maximum 90 percent, non-condensing.

1.9 WARRANTY

A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Wattstopper (Basis of Design), Lutron, Leviton, Crestron.
B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide a Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.

1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.

2. Task Lighting: Provide automatic shut off of non essential task lighting in spaces as required by the applicable energy code. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.

3. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
   a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
   b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
   c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
   d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

4. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.

1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.

3. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

4. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
5. Handheld remotes for personal control: On/Off, dimming and scene remotes for control using infrared (IR) communications. Remote may be configured in the field to control selected loads or scenes without special tools.

6. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.

7. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.

8. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.

9. Network Bridge: Provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.

10. Segment Manager: BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.

11. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

12. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

1. Features of the DLM local network include:
   a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
   c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
   d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.
2.3 DIGITAL LOAD CONTROLLERS

A. Digital Load Controllers: Digital controllers for lighting zones and fixtures automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n’ Go applications. Control units include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
   a. Data transmission
   b. Device has power
   c. Status for each load
   d. Configuration status
5. Quick installation features including:
   a. Standard junction box mounting
   b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
   a. Turn on to 100 percent
   b. Turn off
   c. Turn on to last level
7. Each load be configurable to operate in the following sequences based on occupancy:
   a. Auto-on/Auto-off (Follow on and off)
   b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
   a. Load status
   b. Schedule state, normal or after-hours
   c. Demand Response enable and disable
   d. Room occupancy status
   e. Total room lighting watts
   f. Electrical current
   g. Total watts per controller
   h. Total room watts/sq ft.
   i. Force on/off all loads
10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
   a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.

c. The following dimming attributes may be changed or selected using a wireless configuration tool:
   1) Establish preset level for each load from 0-100 percent
   2) Set high and low trim for each load
   3) Initiate lamp burn in for each load of either 0, 12 or 100 hours

d. Override button for each load provides the following functions:
   1) Press and release for on/off control
   2) Press and hold for dimming control

e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.

g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.

h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. On/Off Room Controllers shall include:
   1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
   2. One or two relay configuration
   3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
   4. Three RJ-45 DLM local network ports with integral strain relief and dust cover

C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
   1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
   2. Optional real time current and voltage monitoring (with - M Monitoring option).
   3. One or two relays configurations
   4. Smart 150 mA switching power supply
   5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
   6. One dimming output per relay
      a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting
   7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
   8. WattStopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.

D. On/Off/0-10V Dimming Enhanced Room Controllers shall include:
   1. Dual voltage (120/277 VAC, 60 Hz) capable or 347 VAC, 60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
   2. Built in real time current monitoring
   3. One, two or three relays configurations
   4. Smart 250 mA switching power supply
   5. Four RJ-45 DLM local network ports. Provide integral strain relief
6. One dimming output per relay
   a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).

7. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton configuration for the following variables:
      a. Sensitivity, 0-100 percent in 10 percent increments
      b. Time delay, 1-30 minutes in 1 minute increments
      c. Test mode, Five second time delay
      d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
      e. Walk-through mode
   2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   3. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.
      b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
      c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
      d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
         e. Ultrasonic and Passive Infrared
         f. Ultrasonic or Passive Infrared
         g. Ultrasonic only
         h. Passive Infrared only
         i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
   4. One or two RJ-45 port(s) for connection to DLM local network.
   5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
   6. Device Status LEDs, which may be disabled for selected applications, including:
      a. PIR detection
      b. Ultrasonic detection
      c. Configuration mode
      d. Load binding
   7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
   9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
B. BACnet object information shall be available for the following objects:
   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic

C. Units shall not have any dip switches or potentiometers for field settings

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton configuration for the following variables:
      a. Sensitivity: 0-100 percent in 10 percent increments
      b. Time delay: 1-30 minutes in 1 minute increments
      c. Test mode: Five second time delay
      d. Detection technology: PIR, Dual Technology activation and/or re-activation.
      e. Walk-through mode
      f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   2. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.
      b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
      c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
      d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hour (AH) time periods. The retrigger mode can be programmed to use the following technologies:
         1) Ultrasonic and Passive Infrared
         2) Ultrasonic or Passive Infrared
         3) Ultrasonic only
         4) Passive Infrared only
   3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
   4. Two RJ-45 ports for connection to DLM local network.
   5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
   6. Device Status LEDs including
      a. PIR detection
      b. Ultrasonic detection
      c. Configuration mode
      d. Load binding
   7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
   8. Assignment of local buttons to specific loads within the room without wiring or special tools
9. Manual override of controlled loads
10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic
   4. Button state
   5. Switch lock control
   6. Switch lock status

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
   1. Left button
      a. Press and release - Turn load on
      b. Press and hold - Raise dimming load
   2. Right button
      a. Press and release - Turn load off
      b. Press and hold - Lower dimming load

F. Low voltage momentary pushbuttons shall include the following features:
   1. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
   2. The following button attributes may be changed or selected using a wireless configuration tool:
      a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
      b. Individual button function may be configured to Toggle, On only or Off only.
      c. Individual scenes may be locked to prevent unauthorized change.
      d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
      e. Ramp rate may be adjusted for each dimmer switch.
      f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
      g. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.
4. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
   d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
5. Programmable control functionality including:
   a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
   b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Button state
   2. Switch lock control
   3. Switch lock status

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
   1. Individual button function may be configured to Toggle, On only or Off only.
   2. Individual scenes may be locked to prevent unauthorized change.
   3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   4. Ramp rate may be adjusted for each dimmer switch.
   5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.7 DLM HANDHELD USER INTERFACE REMOTES

A. Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:
   1. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.
   2. LED on each button confirms button press.
3. Load buttons may be bound to any load on a load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
4. Inactivity timeout to save battery life.

B. Provide with a wall mount holster and mounting hardware for each remote.

C. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

2.8 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.

1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
3. Dual loop sensors measure both ambient and incoming daylight in the space to ensure that proper light levels are maintained as changes to reflective materials are made in a single zone

B. Digital daylighting sensors shall include the following features:

1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
   a. Light level
   b. Day and night setpoints
   c. Off time delay
   d. On and off setpoints
   e. Up to three zone setpoints
   f. Operating mode - on/off, bi-level, tri-level or dimming

14. One RJ-45 port for connection to DLM local network.

15. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.

16. Any load or group of loads in the room can be assigned to a daylighting zone

17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).

18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Open loop digital photosensors shall include the following additional features:
   1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
   2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
   3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
   4. WattStopper Product Number: LMLS-500, LMLS-500-L.

2.9 HANDHELD CONFIGURATION TOOLS

A. Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:
   1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
   2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
   3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
   4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C. WattStopper Product Numbers: Handheld LMCT-100

2.10 DLM SEGMENT NETWORK

A. Provide a segment network using linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.
   1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
   2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
   3. Segment network utilizes 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
   4. Network wire jacket is available in high visibility green, white, or black.
   5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
   6. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
   7. Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER or LMSM Unit. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.


2.11 NETWORK BRIDGE

A. Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
   1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
   2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
3. Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
   a. Read/write the normal or after hours schedule state for the room
   b. Read the detection state of each occupancy sensor
   c. Read the aggregate occupancy state of the room
   d. Read/write the On/Off state of loads
   e. Read/write the dimmed light level of loads
   f. Read the button states of switches
   g. Read total current in amps, and total power in watts through the load controller
   h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
   i. Activate a preset scene for the room
   j. Read/write daylight sensor fade time and day and night setpoints
   k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
   l. Set daylight sensor operating mode
   m. Read/write wall switch lock status
   n. Read watts per square foot for the entire controlled room
   o. Write maximum light level per load for demand response mode
   p. Read/write activation of demand response mode for the room
   q. Activate/restore demand response mode for the room

B. WattStopper product numbers: LMBC-300

2.12 SEGMENT MANAGER

A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manager via external BACnet-to-IP interface routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the Drawings.

C. Operational features of the Segment Manager shall include the following:
   1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
   2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. The Segment Manager shall not require installation of any lighting control software on an end-user PC.
   3. Log in security capable of restricting some users to view-only or other limited operations.
4. Segment Manager shall provide two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system, and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:
   a. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
   b. Allow information for all discovered DLM devices to be imported into the Segment Manager.
   c. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
   d. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.
   e. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.

5. Capabilities using the Segment Manager's Dashboard Screens shall include:
   a. A dynamic "tile" based interface that allows easy viewing of each individual room's lighting power consumption, and lighting power density (power consumption information requires Enhanced DLM Room Controllers with integral current transducers such as LMRC-21x). Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles use three color coded energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. Tile interface shall be accessible via mouse, or touch screen devices. Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.
   b. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms with either on/off or normal hours/after hours set controlled zones or areas to either a normal hours or after hours mode of operation. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as astro On or astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week or month.
   c. Ability to provide a simple time vs. power graph based on information stored in each Segment Manager's memory (typically two to three days' data).

6. If shown on the Drawings, Segment Managers shall be integrated into a larger control network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Segment Manager interface software with
dedicated communication and networking capability, able to pull information automatically from each individual Segment Manager in the network. By using a Supervisor, information for individual Segment Managers can be accessed and stored on the Supervisor's hard drive, eliminating the risk of data being overwritten after a few days because of Segment Manager memory limits.

7. Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

D. Segment Manager shall support multiple DLM rooms as follows:
1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).
2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).


2.13 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. Parameters include but are not limited to:
1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1 second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

B. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
1. Device list report: All devices in a project listed by type.
2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).

7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

C. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
   1. Set, copy/paste an entire project site of sensor time delays.
   2. Set, copy/paste an entire project site of sensor sensitivity settings.
   3. Search based on room name and text labels.
   4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
   5. Filter by parameter value to search for product with specific configurations.

D. Network-wide firmware upgrading remotely via the BACnet/IP network.
   2. Mass firmware update of specifically selected rooms or areas.
   3. Mass firmware upgrade of specific products

E. WattStopper Product Number: LMCS-100, LMCI-100

2.14 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
   1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
   2. Push to test button
   3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.
3.2 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
   1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
   2. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty.
   3. Low voltage wiring topology must comply with manufacturer's specifications.
   4. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
1. Verify Class I and II wiring connections are terminated properly by validating system performance.
2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
4. Verify that the control of each space complies with the Sequence of Operation.
5. Correct any system issues and retest.

C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
1. Date of test or inspection.
2. Loads per space, or Fixture Address identification.
3. Quantity and Type of each device installed
4. Reports providing each device's settings.

3.4 DEMONSTRATION AND TRAINING

A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
1. Confirmation of entire system operation and communication to each device.
2. Confirmation of operation of individual relays, switches, and sensors.
3. Confirmation of system Programming, photocell settings, override settings, etc.
4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.5 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.
SECTION 28 3100
FIRE ALARM SYSTEM

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. Modify, renovate, and expand the existing fire alarm system as indicated on the Drawings and as specified herein.
   1. The existing fire alarm system serving the building shall herein be referred to as the "existing system".
   2. The fire detection and alarm system for the areas of renovation work shall herein be referred to as the "system".

C. This specification describes the modification of an integrated fire detection and alarm system, digital protocol, addressable intelligent device, analog detecting, electrically supervised, low voltage and modular with multiplex communication techniques, in full compliance with applicable codes and standards. The features described in this specification are a requirement for this project and shall be furnished by the successful contractor.
   1. Modifications to the existing system as described shall be installed, tested, and delivered complete and fully operational in all modes and conditions of operation. The completed system shall include required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the Drawings, whether itemized or not.
   2. Equipment furnished shall be new and the most current products of a single manufacturer, engaged in the design and manufacture of analog fire detection and alarm devices and systems for over 10 years. The equipment manufacturer shall have an installed base of comparable systems as a reference. In the interest of job coordination, the 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 shall be selected to meet the requirements for this project.

1.2 MATERIALS AND SERVICES

A. Modifications to the existing system shall include, but not be limited to, the following elements:
   1. Equipment enclosures.
   2. Circuit interface panels to include each module required to perform the functions specified herein or described on the Drawings.
   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. Audible and visual evacuation signals.
8. Software and firmware upgrade and modification as required to provide a complete functioning system.
9. Conductors, raceways and boxes shall be furnished and installed in compliance with the requirements of Sections 26 0519, 26 0533 and 26 0537.
10. Installation, testing and certification and training.
11. Interface with air handling units and motor controllers as indicated on Drawings.

### 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:
2. National Fire Protection Association (NFPA):
   c. NFPA 70 National Electrical Code (NEC).
   d. NFPA 72 Standard for the Installation, Maintenance and use of Protective Signaling Systems (Fire Alarm Code)
   e. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
3. Underwriters' Laboratories, Inc. (UL): Appropriate UL Standards, including:
   a. UL 38 Manually Activated Signaling Boxes.
   b. UL FPED - Fire Protection Equipment Directory.
   c. UL 217 Smoke Detectors for Single Stations.
   d. UL 228 Door Holders for Fire Protective signaling systems.
   e. UL 268 Smoke Detectors for Fire Protective Signaling systems.
   f. UL 268A Smoke Detectors for duct applications.
   g. UL 346 Waterflow indicators for Fire Protective signaling systems.
   h. UL 464 Audible signaling appliances.
   i. UL 521 Heat Detectors for Fire Protective signaling systems.
   j. UL 864 UOJZ Control Units for:
      1) Fire Protective Signaling Systems.
      2) Local Signaling Unit.
      3) Central Station Signaling Protected Premises Unit.
      4) Remote Signaling Protected Premises Unit.
   k. UL 910 Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air.
   l. UL 1424 Cables for Power-Limited Fire Alarm Circuits.
   m. UL 1481 Power Supplies for Fire Protective Signaling systems.
   n. UL 1638 Visual signaling appliances.
   o. UL 2196 Circuit Integrity Two-Hour Flame Test.
4. Texas Department of Licensing and Regulation.
5. Americans with Disabilities Act.
7. ASME A17.1 Elevator Code.
1.4 QUALIFICATIONS OF THE INSTALLER

A. Before commencing work, submit data showing that the Installer has successfully provided fire alarm systems of the same type and design as specified. The Contractor shall include the names and locations of at least two installations where the Installer has provided such systems. Specify the type and design for each system and furnish documentation that the system has performed satisfactorily for the preceding 18 months.

B. References and instructions in this Section are to the Contractor holding overall responsibility for the coordination and proper execution of work on this project. No references to subcontractors, installing contractors, manufacturer’s representatives, or technicians shall absolve the Contractor from the responsibility for the proper execution of work specified in this and related Sections to furnish, install, startup, test, and place into proper operation a complete and functioning fire detection and alarm system.

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. Submit the following information, product data, and shop drawings prior to fabrication:

1. Data describing more than one type of item shall be clearly marked to indicate the type the Contractor intends to provide for options not crossed out in submittal material. 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 existing system master fire alarm control panel.

2. Compatibility. Compatibility of new and existing equipment including voltages, connections, and other characteristics shall be indicated in the submittal.

3. Complete manufacturer’s catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.

4. Submit panel configuration and interconnection of modules and other data as required to make an informed judgment regarding product suitability. At a minimum, data shall be submitted on the following:
   a. Circuit interface panels to include modules required for functions specified herein or required by Code.
   b. Power supplies, batteries and battery chargers.
   c. Pre-amplifiers, amplifiers, and tone generators.
   d. Equipment enclosures, including dimensions and weights of completed units.
   e. Intelligent addressable manual pull stations, heat detectors, analog smoke detectors, multi-sensor detectors, duct detectors, alarm monitoring modules, addressable relays, and supervised control modules.
   f. Audible and visual evacuation signals and devices.
g. Software and firmware upgrades and modifications as required to provide a complete functioning system.

h. Circuiting, including conduit and wire sizes.

5. Power calculations:
   a. Battery capacity calculations: Battery size shall be a minimum of 125% of the calculated requirement.
   b. Supervisory power requirements for equipment.
   c. Alarm power requirements for 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.

6. Complete shop drawings covering the following shall be submitted by the Contractor for the proposed system:
   a. Floor plans, scaled to 1/8” = 1'-0”, showing communicating, initiating, end of line, supervisory, indicating appliances, and output control devices; including circuit interface panels, message digitizers, amplifiers, 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. Where components indicated on plans are too congested to adequately describe the system function, provide enlarged plans scaled to 1/4” = 1'-0”.
   b. Wiring diagrams showing points of connection and terminals used for electrical connections to the system devices and panels.

7. Statements shall be included, with copies of required licensing, verifying the qualifications of the installer as specified.

B. Submit a complete operation and maintenance manual with two sets of proposed installation drawings for use in system test.
   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 installer.
      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, submit record drawings on the completed system before final acceptance of the work.
   1. 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 CD-ROM or other suitable electronic media in an AutoCAD DXF format and in Adobe portable document file (pdf) format.
2. Include a complete system database with a description of logic strings, control by event programming, and point identification labels on a CD-ROM or other suitable electronic media and in a formatted printed form, as required for off-site editing, uploading and downloading. A programming manual shall accompany the submitted program and shall be adequate to allow understanding, operation and editing by the system Owner.

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, digital protocol, and addressable devices. Modifications and extensions of the existing system shall be as described herein and as shown on the Drawings.

1. The maximum number of devices on a single signaling circuit shall be limited according to manufacturer’s recommendations and shall not exceed one hundred, in order to avoid catastrophic loss of device communications in the event of a raceway destruction, with a capacity of one hundred reporting system inputs and one hundred system control outputs. Systems capable of serving in excess of one hundred devices on a single communications circuit (i.e., signaling line circuit) shall be wired and controlled in a Style 7 configuration including isolation circuitry limiting short circuit fault to a maximum of one hundred 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 the 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 requirement for cleaning, and tested by a single technician using the panel field test routine.

b. Sensitivity settings of individual detectors shall be automatically or manually adjustable from the control panel to reduce the incidence of false alarms caused by environmental conditions.

c. The analog signaling circuits shall be installed in the fire alarm control panel enclosure or in remote circuit interface panel enclosures.

d. Analog signaling circuits shall support selectable Style 4 or Style 7 wiring using loop isolator modules.

2. The system shall support intelligent analog smoke detection, heat detection, multi-sensor detection, manual station, water flow, supervisory, security, and status monitoring devices. Fire alarm, supervisory, trouble, security and status shall each be treated as a separate level of alarm, each with its own level of priority. The system shall also support amplifiers, voice/visual circuits, addressable relays and modules for interface with HVAC system motor controllers.

3. The panel shall be UL listed as a test instrument for the measurement and logging of the sensitivity of connected intelligent analog smoke detectors connected to the control panel or remote circuit interface panel to comply with the bi-annual sensitivity logging requirements of NFPA 72:

a. The measurements shall be discrete voltage readings, accurate to .01 VDC. The readings shall be dynamic, providing a constant display of voltage shifts of the device being tested when in the sensitivity voltage list mode.

b. When programmed, each system connected light refraction style smoke detector shall be capable of self adjustment to compensate for the accumulation of contaminates that would change the detector sensitivity in either a more or less sensitive direction. This adjustment shall keep the relationship between the sensing chamber voltage and the programmed alarm threshold voltage constant to prevent
false indications or failure to alarm in the presence of smoke. Data contained in a memory bank on each detector so programmed, shall maintain an average of the chamber voltage in determining the threshold setting for the device. The threshold setting installed in memory within each device shall maintain programmed operation under anticipated conditions of operation, including default trouble and default alarm modes. Devices programmed with this feature shall be automatically tested by the control panel once every twenty four hours to assure their ability to detect and report an alarm condition. This test shall be done as a background routine and shall remain transparent to the user. In the event of a test failure, the control panel shall report a trouble message for the failed device.

c. Trouble messages displayed by the system LCD displays and logged to system printers and memory shall be programmed with a custom label as selected by the Owner to identify the origin by cabinet, room number or other information meaningful to assist maintenance employees.

4. The system shall annunciate a pre-clean trouble condition when a 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. 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. Intelligent analog smoke detectors 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 unverified alarm events in order to track activity and generate reports indicating maintenance requirements prior to failures within the system.

6. External circuits shall be listed as power limited circuits per the National Electric Code (NEC). 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 circuit interface panel shall receive an alarm from local intelligent analog or conventional initiating device. The circuit interface panel 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. The system shall also 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 remote circuit interface panels, 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. 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 communicate with the existing system as a node on the existing central or distributed multiplex architecture. The system shall, as a minimum, provide a power supply, microprocessor controlled bus structure, battery and automatic charger, and communication link to the existing system main CPU through the communications network of the existing system.

13. The system shall provide status indicators and control switches for the following functions:
   a. Audible and visual evacuation alarm circuit zone control.
   b. Status indicators for sprinkling system waterflow and valve supervisory devices.

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. Preserve the sequence of operation of the existing system, and modify system such that activation of a 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. Sound an alarm tone for a maximum of five seconds followed by an automatic digital voice message over 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. 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 equal to a single head.
      c. An automatic announcement or tone evacuation signal shall be capable of interruption by the operation of the existing system microphone to give voice
evacuation instructions overriding the preprogrammed sequences. When the microphone button is released, the alarm tone shall resume.

d. Status lights next to speaker selection switches on the control panel shall indicate which of the three messages each speaker circuit is distributing.

3. 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, operator actions shall be logged to system history with time and date.

4. Activation of an AHU duct detector or or associated damper duct detectors or damper smoke detectors shall shutdown that AHU and shall sound a general alarm. Refer to paragraph 3.8A.2, this Section, for fire-smoke damper (FSD) and AHU serving vivarium and animal holding rooms.

5. Other life safety and auxiliary functions as indicated on Drawings; see Fire Alarm System Input/Output (I/O) Matrix.

B. Activation of an 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 first floor lobby, the recall shall be to the alternate floor. Activation of a heat detector in the elevator machine room, elevator pit, or elevator shaft shall shunt trip the circuit breaker serving the associated elevators.

C. Activation of a supervisory circuit; i.e., supervised valve closure, low air pressure, 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.

D. 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.
PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Products and materials furnished and installed for this project shall be OEM products, compatible with existing system.

2.2 FIRE ALARM CONTROL PANEL

A. The master fire alarm panel for the building is an existing panel. Provide components to connect the fire alarm system for the renovation area as a node on the existing system network.

2.3 FIRE ALARM SYSTEM POWER SUPPLIES

A. Primary power for the remote circuit interface panel and the secondary power battery chargers shall be obtained as indicated on Drawings.

B. Secondary power supply:
   1. Provide sealed batteries as the secondary power supply for each system circuit interface panel. Type: gelled electrolyte or absorbed glass-matt (AGM).
   2. 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 fifteen minutes.
   3. Size batteries at 125% of the calculated size for the system load in order to compensate for deterioration and aging during the battery life cycle.
   4. Submit battery calculations to justify the battery size.
   5. House batteries in the control cabinet or a separate cabinet with adequate cell separation to prevent accidental discharge.

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 as required for the remote circuit interface panel to function as specified and described.
   1. Circuit interface panels, when required, shall include conventional zone module, analog loop drivers, indicating appliance circuits, output circuitry to perform actions, speaker supervisory and distribution circuits, and amplifiers. Fire detection, alarm and indicating devices supported by the circuit interface panel shall function as a stand-alone system in the failsafe mode upon loss of the existing system 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, a remote LCD annunciator, or a remote interface panel equipped with a keypad.
2.5 SMOKE DETECTORS, LIGHT REFRACTION

A. Furnish and install, where indicated on the Drawings, intelligent addressable analog smoke detectors with features and characteristics as follows:
   1. Detectors shall be listed for use as an open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes.
   2. Detectors shall be capable of reporting pre-alarm and alarm levels throughout the U.L. defined sensitivity range.
   3. The detector shall be designed with a zero background light level, eliminating calibration errors associated with field cleaning of the chamber.
   4. The detector shall provide complete supervision of the detector optics. The detector shall be supervised for complete failure of the LED light source or a critical reduction in the light output of the LED caused by excessive dirt, which could not normally be compensated for by the automatic-gain control circuit.

B. The detector shall be a plug-in twist/lock unit, which shall be capable of removal from or installation into its base with one hand.

2.6 HEAT DETECTORS, INTELLIGENT RATE COMPENSATED

A. Furnish and install, where indicated on the Drawings, intelligent addressable heat detectors with features and characteristics as follows:
   1. Detectors shall be of the intelligent, rate compensated type rated at 135 degrees. Detectors shall be constructed to compensate for the thermal inertia inherent in conventional type detectors due to the thermal mass, and alarm at the set point of 135°F. Detectors in elevator machine rooms, pit and shaft shall be rated at 175°F.
   2. The detector shall be addressed, tested and programmed prior to installation using a UL listed programmer/tester.
   3. The detector shall be suitable for two wire operation and two way communications on the intelligent analog signaling circuit. The detector shall display a steady LED when in the alarm state when the system is operating from normal or standby power.
   4. 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 72 for open area coverage.

B. The addressable thermal (heat) detector shall be a plug-in, twist-lock unit, which shall be capable of removal from or installation into its base with one hand.

2.7 DETECTORS, MULTI-SENSOR

A. Furnish and install intelligent addressable multi-sensor detectors where indicated on the Drawings, and where required by NFPA 72 and other applicable codes. Provide addressable multi-sensor detectors with features and characteristics as follows:
   1. Multi-sensor detectors shall integrate photoelectric and thermal (heat) sensing technologies into one detector unit. The unit shall be intelligent addressable type.
   2. The photoelectric and heat sensing characteristics and functions of the multi-sensor shall be similar to the sensing characteristics specified herein for the photoelectric and thermal (heat) type sensors.
B. The multi-sensor detector shall be a plug-in unit that mounts on a twist-lock base, similar to the
photoelectric and heat sensors. The multi-sensor detector shall be capable of removal from or
installation into its base with one hand.

2.8 DETECTOR BASE

A. The detector mounting base shall be of the twist-lock type with screw terminals. Pigtails or in-
line connectors shall not be permitted. It shall be possible to secure the detector in the base.

B. The detector mounting base shall be universal for addressable photoelectric detectors,
ionization detectors, heat detectors, and combination/multi-sensor detectors.

C. The detector mounted base shall be compatible with the existing system fire alarm control panel
and system communications network.

D. Provide mounting bases included with each detector as a complete assembly.

2.9 DUCT DETECTORS

A. Furnish and install intelligent addressable duct smoke detectors where indicated on the
Drawings, specified herein, and where required by NFPA 72 or NFPA 90A. Provide addressable
duct smoke detectors with features and characteristics as follows:
1. The air duct smoke detector shall operate on a cross-sectional air-sampling principle to
overcome stratification and skin effect.
2. The air duct detector shall consist of a standard addressable photoelectric detector
mounted in an air duct sampling assembly and sampling tube that protrudes across the
duct of the ventilation system.
3. The air duct detector shall retain the features of the addressable photoelectric detector,
and be installed in the ventilation duct as indicated in the manufacturer’s instructions.
4. The air duct smoke detector shall come with appropriate addressable detector and base,
remote test station, and inlet sampling tubes.

B. Ionization Type Duct Detectors. Where accepted in writing by the Owner’s Representative and
the Architect/Engineer, intelligent addressable duct smoke detectors may employ ionization-type
detectors in lieu of photoelectric detectors.

2.10 MANUAL STATIONS, INTELLIGENT

A. Provide single action intelligent manual stations where shown on the Drawings, to be flush or
surface mounted as required:
1. Station shall be equipped with terminal strip and pressure style screw terminals for the
connection of field wiring.
2. The manual stations shall be addressable and identifiable by the existing system 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.
3. Surface mounted stations where indicated on the Drawings shall be mounted using a
manufacturer's prescribed matching baked red enamel outlet box.
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.
   3. Dual circuit input and three-circuit input modules, similar to interface modules described in paragraph 2.11A.1 above, for monitoring multiple alarm, trouble, and supervisory status contact-type devices grouped in close proximity.

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. Coordinate with Division 21 to furnish sensors for installation by the fire sprinkler system installer and provide system interconnection for the following functions:
   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.

B. Where shunt-trip of electrical power to elevator is actuated by sprinkler flow switch, provide devices with no intentional delay.

2.13 INTELLIGENT SUPERVISED CONTROL MODULE

A. Furnish and install for the control of supervised relays, motor controllers, contactors, audible signal circuits, visual signal circuits, and distributed speaker 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 inch deep, 4 inch square or double gang electrical outlet box, having a depth of 3-1/2 inches.
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. Connected field wiring shall be supervised for opens, short circuits and grounded circuits.
2. Controlled circuits shall be power limited at 1.5A, produced by selfrestoring 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, VOICE REPRODUCING

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. Provide audible alarm units that produce a sound exceeding the prevailing equivalent sound level in the room or space by at least 15 dBA, or that exceeds a maximum sound level with a duration of 60 seconds by 5 dBA, whichever is louder. Audible alarm units shall not exceed 120 dBA.

B. Strobe Light: ADA visual notification appliances shall use a xenon flashtube and shall 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 of unfiltered or clear filtered white light. The Lexan lens shall be pyramidal in shape to allow better visibility. Refer to Drawings for strobe light candela ratings. The Contractor shall verify candela ratings based on the room size and NFPA requirements. Where there are discrepancies the requirements of NFPA 72 for candela rating shall take precedence over the values shown on the Drawings. The Contractor is also responsible for sizing strobes and selecting candela ratings per NFPA 72 based on room size and device location. Three or more strobes within the same line of site shall be synchronized. Provide multi-tap strobes to allow for a full range of candela settings. Settings shall be 15/75, 30/75, 75 or 110 candela. Xenon strobe shall have a minimum repetition rate of 1 HZ, not exceeding 3 HZ and a maximum duty cycle of 40% with a pulse duration of 0.2 seconds. Circuits for strobes shall allow for capacity to increase strobe intensities one setting. 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 the lettering “FIRE” visible from a 180-degree field of view. The front panel or bezel shall be constructed of UL listed Noryl, and shall permit inverted installation 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 2.14B, this Section. Xenon strobe shall provide 4-wire connection to insure properly supervised in/out system connection. Unit shall be complete with 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 2.14A, this Section. 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 required project applications. Visual only and combination audio/visual alarms shall be white with red "FIRE" lettering.

E. Terminals. Pressure type screw terminals with capacity to use up to 12 AWG wire for speaker connection.

F. Environmental Rooms: Provide in each environmental room a Visible Alarm Notification Appliance as described in Paragraph 2.14B, this section. Coordinate with Environmental Room supplier to provide a weatherproof, gasketed box inside each environmental room for installation of notification appliances, with a sealed conduit through the environmental barrier to a weatherproof, gasketed box mounted to the exterior of the environmental room. Listed operating environment for Visible Alarm Notification Appliances in environmental rooms shall be compatible with the design temperature and design humidity of the environmental room. Coordinate with Division 13 and the environmental room supplier for environmental room parameters, schedule, and installation provisions and requirements.

2.15 MAGNETIC HOLD OPEN DEVICE

A. Provide 120VAC magnetic hold open devices where indicated on Drawings and where required by Code.

B. Provide addressable fire alarm relay at each magnetic hold open device or group of devices to intercept 120-Volt power to the magnetic hold open devices.

C. Magnetic hold open devices shall release upon an alarm condition, allowing the associated door to close.

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 Contractor to verify dimensions and assure compatibility with 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 DELIVERY, STORAGE AND HANDLING

A. Deliver fire alarm system components, individually wrapped, on pallets or packaged in factory-fabricated containers.

B. Store components in a clean, dry space, elevated above grade, and protected from the weather, dirt, sunlight, moisture, and corrosion.

C. Handle products carefully to avoid damage to material components, enclosure and finish. Damaged products shall be rejected and not be installed on this project.

D. Refer to paragraph 3.2 of Section 26 0000, Electrical General Provisions.

3.3 INSPECTION

A. The Installer shall examine the areas and conditions under which the fire alarm system is to be installed and notify the Owner’s Representative in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.4 INSTALLATION

A. Install the system as shown on the Drawings and specified herein. Perform work in accordance with the requirements of NFPA 70 (NEC), NFPA 72, and the manufacturer’s written instructions and recommendations.

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 tapping 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.

C. Coordinate work between Division 26 and the fire alarm system installer to provide conduit and conductors required for the installation of the fire alarm devices and interfacing to the fire alarm system. Conductors shall be UL listed for the fire alarm applications.

D. Imaging and Magnetic Equipment:
   1. Use non-ferrous materials in rooms with equipment employing magnetic devices with elevated gauss fields, such as Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) equipment. Use non-ferrous materials where gauss fields extend into adjacent spaces, and in other locations as indicated on Drawings.
   2. Locate fire alarm sensors and notification appliances outside the limiting magnetic fields of imaging and magnetic equipment, and as indicated on the Drawings and on accepted shop drawings.
   3. Route fire alarm circuits outside of and around rooms with Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) equipment. Limit circuit runs in imaging
areas to in-and-out taps for devices serving imaging areas; do not pass trunk or branch circuits through imaging areas.

4. Provide suitable RFI filters for conductors passing into rooms containing Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) equipment, and adjacent spaces with limiting magnetic fields produced by imaging and magnetic equipment.

3.5 CONDUIT

A. Conductors in exposed areas and where subject to damage shall be installed in conduit per the requirements of Section 26 0533, Raceways. Minimum conduit size shall be 3/4 inch.

B. Plenum rated fire alarm cable may be installed above lay-in ceilings. Provide a J-hook support system spaced at 5-feet on center and secured to the structure above. Provide J-hook support within 12 inches of boxes. Maintain a minimum of 12 inches of separation between the plenum-rated fire alarm conductors and the top of the lay-in ceiling system. Refer to Section 26 0529, Metal Framing and Supports.

3.6 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 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 junction box covers. Boxes for fire alarm system devices and wiring shall be red.

B. Junction boxes used as back boxes for fire alarm system field devices shall be 4-inch square, with 2 1/8-inch minimum depth. Install adapter plates and extension rings where required. Junction boxes for concealed conduit system shall be flush mounted.

C. Provide boxes for devices requiring such. Boxes for wall-mounted visual signals shall be mounted such that the bottom of the lens of the visual device (strobe) is at least 80 inches above the highest level of the finish floor and the top of the lens is no more than 96 above the highest level of the finish floor.

D. Mount outlet box for electric door holder to withstand applied pulling force, minimum of 80 pounds.

E. Environmental Rooms. Coordinate with Division 13 and the environmental room supplier for installation provisions in environmental rooms for Visible Alarm Notification Appliances. Coordinate with Division 13 and the environmental room supplier to provide a factory-installed weatherproof, gasketed box inside each environmental room for installation of notification appliances, and at the exterior of each environmental room, with a sealed conduit connection between the two boxes. All mounting, fastening, drilling, cutting, and other penetrations inside the environmental room or through the environmental barrier of the room shall be done by Division 13 or the environmental room supplier and shall be sealed by Division 13 or the environmental room supplier to maintain the environmental integrity of the chamber and barrier.
F. Refer to Section 26 0537 for additional requirements for boxes.

3.7 CONDUCTORS

A. Identify Conductors as shown on the shop drawings with wire markers at splice and terminal points. Attach permanent wire markers within 2 inches of each termination. Marker legends shall be visible.
1. Conductors shall be supplied and installed in compliance with the requirements of the National Electric Code (NFPA 70) Article 760, NFPA 72, applicable UL standards, and those of the manufacturer.
2. Conductor size for analog loop circuits and speaker circuits shall be minimum 18 AWG twisted pair. Conductor size for strobe circuits shall be minimum 14 AWG. Use larger conductors as required to comply with voltage drop requirements. Refer to paragraph 1.6A.5.f, this Section.
3. Make splices using solderless connectors. Install connectors in conformance with the manufacturer’s recommendations.
4. Use crimp-on type spade lugs 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.
5. Refer to Section 26 0553 for additional requirements for identification.

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 in other locations as required per code.

D. Provide plenum-rated cable where conduit is omitted; refer to paragraph 3.5B of this Section.

E. Environmental Rooms. Coordinate with Division 13 and environmental room supplier to install cabling to the Visible Alarm Notification Appliances installed inside each environmental room. Where terminal boards are provided for connection of cabling and communication across the environmental barrier of the room, verify compatibility of the terminal board with the cabling system, NFPA, and other applicable codes and standards. Where a separate penetration through the barrier of the environmental room is required, coordinate with Division 13 and environmental room supplier to provide a hermetically sealed, gasketed, re-usable gland assembly to maintain the environmental integrity of the room barrier. Mounting, fastening, drilling, cutting, and other penetrations inside the environmental room or through the environmental barrier of the room shall be done by Division 13 and shall be sealed by Division 13 to maintain the environmental integrity of the chamber and barrier.

3.8 INTERFACE

A. Building Controls and HVAC Systems:
1. Coordinate with Division 23 and suppliers for air handling units (AHUs) and associated variable frequency drives (VFDs) for shutdown of AHUs in response to a smoke condition detected at the AHU supply and/or return, as required by NFPA 90A. This coordination effort includes the sheet metal supplier for HVAC ductwork, for installation and interface of duct smoke detectors as indicated on Drawings.
2. Coordinate with Division 23 and fire smoke damper (FSD) supplier for interface and control between the fire alarm system and FSDs, to shut FSDs in response to a smoke
condition detected at the FSD or associated AHU, and as further required by the system sequence of operation and the fire alarm system functional I/O matrix. This coordination effort includes the sheet metal supplier for HVAC ductwork, for installation and interface of duct smoke detectors as indicated on Drawings in Construction Documents and on submitted Shop Drawings.

a. Coordinate release of smoke dampers with shutdown of AHUs to prevent tripping of AHUs on high static pressure. This shall typically be accomplished by programming the fire alarm system to trip the AHU and initiate an adjustable, programmable time delay. Upon expiration of the time delay, the fire alarm system shall release (shut) the associated smoke damper.

b. Time delay for release of smoke damper shall be initially set to zero seconds. Time delay may be adjusted where field testing or code requirements indicate the need for a shorter or longer delay period.

c. Coordinate shutdown of AHU and release of associated smoke dampers so that one alarm signal from associated duct detectors will initiate AHU shutdown and release of associated smoke dampers.

B. Elevator:
1. Coordinate with Owner to verify elevator recall to primary (ground) floor and alternate (second) floor, as indicated on Drawings.
2. Coordinate with Division 26, and Owner to verify shunt trip of power to elevator hydraulic unit upon activation of a heat detector in the elevator shaft, pit, or elevator equipment room, and upon initiation of sprinkler system water flow into the elevator shaft or elevator equipment room.
3. Shunt trip of power to the elevator hydraulic unit shall be accomplished by direct action of the heat detector or associated fire alarm control module and shall operate independently (i.e., stand-alone) in the event of loss of communications with the fire alarm control panel.

3.9 FIELD QUALITY CONTROL

A. Testing, General:
1. 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 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. 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. Test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the Contractor. The following equipment shall be a minimum for conducting the tests:
   a. Ladders and scaffolds as required to access installed equipment.
   b. Multimeter for reading voltage, current and resistance.
   c. Intelligent device programmer/tester.
   d. Laptop computer with programming software for required program revisions.
e. Two way radios, flashlights, smoke generation devices and supplies. "Canned smoke" systems are not acceptable.
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 Contractor, the installation shall be subject to test by the acceptance inspector and the Owner’s Representative.

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 system components, circuits, and programming.

2. A program matrix shall be prepared by the 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 device labels for alpha-numeric annunciator displays and logging printers shall be prepared by the 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 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.
      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) 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 existing system control panel, each remote alphanumeric display and each computer (pc) 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 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 and the Owner's Representative, the test shall be terminated.
   a. The Contractor shall retest the system, correcting 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 system functions, and inputs and outputs affected 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 and the Owner's Representative 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.

3.10 SPARES

A. Provide as spares 25 percent of the quantity of audible and combination visual/audible alarm notification devices indicated on Drawings.

B. Install and connect additional alarm notification devices in locations as directed by Owner's Representative, Fire Marshall, and TAMU construction inspector. Furnish, install, connect, and program devices at no additional cost to Owner. Spare devices furnished under paragraph 3.10A, this Section, may be used.

C. Spare alarm notification devices not used or installed under 3.10B, this Section, shall be delivered to Owner as spares or “attic stock” at time of Owner acceptance.

3.11 DOCUMENTATION

A. System documentation shall be furnished to the Owner in accordance with paragraph 1.6C of this Section. Documentation 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 CD-ROM or other suitable electronic media in a DXF format suitable for use in a CAD drafting program.
   2. System operation, installation and maintenance manuals
   3. Written documentation for logic modules as programmed for system operation with a matrix showing interaction of 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 CD-ROM or other suitable electronic media with system file.

B. Certificate of Compliance. Complete and submit to the Owner in accordance with NFPA 72.
1. Following field testing and inspection, install inspection certification tags prior to substantial completion. The white installation sticker date must indicate the approved substantial completion date, which shall also be the warranty start date.

2. Fire alarm system shall meet Texas State Fire Marshall requirements as defined by Texas Administrative Code (TAC).

3. Provide labeling per TAC 34.6 Fire Alarm Rules, 34.620 Installation and Service Labels.

3.12 TEST EQUIPMENT

A. The Contractor shall furnish to the Owner test equipment as required to program devices and test the system, specifically an intelligent device tester and programmer.

3.13 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, provide at no additional charge the inspection, parts, maintenance, testing and repair in full compliance with the requirements of NFPA 72. The contractor performing the contract services shall be qualified and listed to maintain ongoing certification of the completed system to the UL for specific installed system listing.

C. Provide 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 items specified.

END OF SECTION
University of North Texas - Chemistry Building
Chemistry 3rd Floor  Welch Chair Laboratory Renovation

ISSUED FOR CONSTRUCTION
December 18, 2020

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GENERAL NOTES

PROJECT LOCATION
Chemistry Building
1508 W Mulberry St, Denton, TX 76201

DESIGN STANDARDS

VICINITY MAP
Demolition General Notes:

1. Where portions of the existing walls are to be removed, coordinate exact extent of demolition with new work. Dimensions shown are approximate.

2. Remove in-wall blocking for perimeter wall to remain.

3. Notify architect of any unprotected openings or penetrations in rated perimeter wall.

4. Prepare existing surfaces indicated to remain to receive new finishes materials.

5. Field verify existing conditions prior to disconnecting and removing electrical equipment to avoid unnecessary power outages.

6. Remove light fixtures from ceilings scheduled to be removed. Remove branch circuit back to nearest junction box scheduled to remain.

7. Where wall is scheduled to be removed in its entirety, remove wiring and data devices. Remove branch circuit and conduit back to nearest junction box to remain. If entire circuit is removed, label circuit breaker as spare.

8. Where wall is scheduled to be removed in its entirety, remove fire alarm devices and wiring back to nearest junction box.

9. Maintain electrical service to areas outside of scope of work.

10. Where existing walls are to be removed in their entirety, remove wiring and data devices. Remove branch circuit and conduit back to nearest junction box to remain. If entire circuit is removed, label circuit breaker as spare.

11. Remove fire alarm devices and wiring back to nearest junction box.

12. Maintain electrical service to areas outside of scope of work.

13. Where existing walls are to be removed in their entirety, remove wiring and data devices. Remove branch circuit and conduit back to nearest junction box to remain. If entire circuit is removed, label circuit breaker as spare.

14. Remove fire alarm devices and wiring back to nearest junction box.

15. Maintain electrical service to areas outside of scope of work.

16. Where existing walls are to be removed in their entirety, remove wiring and data devices. Remove branch circuit and conduit back to nearest junction box to remain. If entire circuit is removed, label circuit breaker as spare.

17. Remove fire alarm devices and wiring back to nearest junction box.

18. Maintain electrical service to areas outside of scope of work.

19. Where existing walls are to be removed in their entirety, remove wiring and data devices. Remove branch circuit and conduit back to nearest junction box to remain. If entire circuit is removed, label circuit breaker as spare.

20. Remove fire alarm devices and wiring back to nearest junction box.

21. Maintain electrical service to areas outside of scope of work.
CAREFULLY REMOVE CEILING TILE AND GRID AND RESINSTALL TO COMPLETE PLUMBING MODIFICATIONS. REF PLUMBING DRAWINGS FOR EXTENT OF WORK.

1. WHERE PORTIONS OF THE EXISTING WALLS ARE TO BE REMOVED, COORDINATE EXACT EXTENT OF DEMOLITION WITH NEW WORK.
2. REMOVE IN-WALL BLOCKING FOR PERIMETER WALL TO REMAIN.
3. NOTIFY ARCHITECT OF ANY UNPROTECTED OPENINGS OR PENETRATIONS IN RATED PERIMETER WALL.
4. PREPARE EXISTING SURFACES INDICATED TO REMAIN TO RECEIVE NEW FINISHES MATERIALS.
5. FIELD VERIFY EXISTING CONDITIONS PRIOR TO DISCONNECTING AND REMOVING ELECTRICAL EQUIPMENT TO AVOID UNNECESSARY POWER OUTAGES.
6. REMOVE LIGHT FIXTURES FROM CEILINGS SCHEDULED TO BE REMOVED. REMOVE BRANCH CIRCUIT BACK TO NEAREST JUNCTION BOX SCHEDULED TO REMAIN.
7. WHERE WALL IS SCHEDULED TO BE REMOVED IN ITS ENTIRETY, REMOVE WIRING AND DATA DEVICES. REMOVE BRANCH CIRCUIT AND CONDUIT BACK TO NEAREST JUNCTION BOX TO REMAIN. IF ENTIRE CIRCUIT IS REMOVED, LABEL CIRCUIT BREAKER AS SPARE.
8. WHERE WALL IS SCHEDULED TO BE REMOVED IN ITS ENTIRETY, REMOVE FIRE ALARM DEVICES AND WIRING BACK TO NEAREST JUNCTION BOX.
9. MAINTAIN ELECTRICAL SERVICE TO AREAS OUTSIDE OF SCOPE OF WORK.
10. IN PERIMETER WALLS SCHEDULED TO HAVE INTERIOR WALL BOARD REMOVED, ALL DEVICES SHALL REMAIN IN PLACE AND FUNCTIONAL.

DEMOLITION GENERAL

NOTES

PARTIAL LEVEL 2 DEMOLITION RCP C1
Provide piping in fume hood to vacuum cabinet below and adjacent to fume hood.

Provide hoods pre-piped for services indicated and connect to dedicated exhaust duct when vent into fume hood or to adjacent lab area.

**Laboratory Equipment Schedule (Owner Furnished)**

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<th>Model</th>
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<td>Example</td>
<td>Model 2</td>
<td>Description</td>
<td>Volts</td>
<td>Amps</td>
<td>Phase</td>
<td>Size</td>
<td>Notes</td>
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</table>

**Symbols List**

- CABITION TYPE
- LABORATORY SERVICES
- LABORATORY EQUIPMENT
- 6" Fume Hood
- OP Fume Hood, Adjacent
- LINEAR SERVICE PANEL
- DAMPER ABOVE CLG.
- CLASS II/A2 WITH ADJUSTABLE STAND.
- OPT:
  - SNORKEL EXHAUST (OFOI)
  - DOUBLE ELECTRICAL PANEL - SHOWN
  - TO TERMINATE EXHAUST DUCT 6"
  - DAMPER ABOVE CLG. EQUIPMENT EXHAUST
  - 5'-0" BIOSAFETY CABINET

**Emergency Shower - Eye Wash**

- Footage: 1/2" = 1'-0"

**Wall Shelves**

- Footage: 1/2" = 1'-0"

**Tall Cabinets**

- Footage: 1/2" = 1'-0"

**Specialty Cabinets**

- Footage: 1/2" = 1'-0"
MECHANICAL GENERAL NOTES:

1. THESE GENERAL NOTES APPLY TO ALL MECHANICAL DRAWINGS.
2. ALL ELEVATIONS INDICATED ARE WALL ELEVATIONS AND ARE TO BE READ FROM THE PRESENTED PLAN DIRECTIONS, EXCEPT TO THE BOTTOM OF CEILINGS.
3. All MOUNTING TEMPERATURES AND HUMIDITY REQUIREMENTS ARE BASED ON A 30°F (1° C) DOWNTURN FROM DESIGN TEMPERATURES.
4. PROVIDE PIPE DAMPERS AND ACCESS DOORS IN ALL EXHAUST LOCATION As NOTED IN THE PROJECT.
5. Refer to architectural drawings for architectural restraints.
6. Those projects shall be supplied with architectural restraints.
7. Hatch lines do not supply any architectural restraint.
8. Refer to user's schedule for size of pipe and damper connection size.
9. Supply ducts shall be the same size as the supply duct size, unless otherwise specified.
10. Refer to mechanical detail for location of typical duct collar detail.
11. Refer to mechanical detail for location of damper installation and connection details.
12. Contractor shall provide all temporary piping, valves, conductors, electrical equipment and temporary controls associated with this project.
13. All temporary piping shall be removed back to active lines and capped. No open piping or ductwork shall remain after completion.
14. Provide access doors in ductwork at fire dampers and fire/smoke dampers. Identify access doors as required.
15. Refer to mechanical detail list for location of supply air ductwork, the top of all supply air diffusers.
16. Provide access doors into ductwork for maintenance purposes. Identify access doors as required.
17. Provide electrical conduit and wiring back to panel. Remove panels not required to accomplish the work indicated.
18. Insulate exterior of all supply air ductwork and the top of all supply air diffusers.
19. Provide seismic bracing for equipment supported by nonstructural members.
20. Provide bleed points on each plan as required by the NEC. (36 inches).
21. By reason of necessity, project construction must be coordinated with existing building, coordinate work to minimize impact on the space. Coordinate all outages required for the project.

MECHANICAL GENERAL NOTES DEMO:

1. CONTRACTOR SHALL USE THE SITE AND RECEIVE FAMILIAR WITH THE PROJECT SCOPE AND SPECIFICATIONS. REFER TO THE APPROPRIATE DRAWING OR DETAIL LIST.
2. REFER TO THE MECHANICAL LEGENDS, NOTES, DRAWING AND DETAIL LIST M-000.
3. CONTRACTOR SHALL PROVIDE ALL TEMPORARY PIPING, VALVES, CONDUCTORS, ELECTRICAL EQUIPMENT AND TEMPORARY CONTROLS ASSOCIATED WITH THIS PROJECT.
4. PROVIDE ALL PRODUCTS OF EQUAL CAPACITY AND QUALITY.
5. CONTRACTOR SHALL DISPOSE OF LEAD CONVEYED DURING ALL DEMOLITION AND TEMPORARY CONDITIONS.
6. CONTRACTOR SHALL PROVIDE DEBRIS AND DUST CONTAINMENT SYSTEM THROUGHOUT PROJECT.
7. REMOVAL OF ALL DEMOLISHED EQUIPMENT AND MATERIALS. (COORDINATE WITH LIGHTING CONTRACTOR TO INCLUDE LIGHTS, FIXTURES AND SHIPS IN THE DUCTWORK.)
8. CHANGING WAS PERT OF REMOVABLE MATERIALS. (COORDINATE WITH LIGHTING CONTRACTOR TO PROVIDE ALL ACCESSORIES REQUIRED TO ACME THE WORK INDICATED. PROVIDE ACCESS DOORS TO FIRE DAMPERS AND FIRE/SMOKE DAMPERS.)
9. PROVIDE ACCESS DOORS IN DUCTWORK AT FIRE DAMPERS AND FIRE/SMOKE DAMPERS. IDENTIFY ACCESS DOORS AS REQUIRED.
10. CONTRACTOR SHALL DISPOSE OF LEAD CONVEYED DURING ALL DEMOLITION AND TEMPORARY CONDITIONS.
11. CONTRACTOR SHALL DISPOSE OF LEAD CONVEYED DURING ALL DEMOLITION AND TEMPORARY CONDITIONS.
12. CONTRACTOR SHALL DISPOSE OF LEAD CONVEYED DURING ALL DEMOLITION AND TEMPORARY CONDITIONS.
GENERAL NOTES:
A. REFER TO THE SHEET TITLED "MECHANICAL LEGENDS & GENERAL NOTES" FOR DETAIL INDEX, LEGEND, NOTES, AND REFERENCES THAT APPLY TO THIS SHEET.

KEYED NOTES - M-201
1. CANOPY HOOD. RE: 3/M-902.
2. EXHAUST DUCT TO SNORKEL CONNECTION. BALANCE TO 110 CFM. RE: 6/M-901 FOR DETAILS.
3. EXHAUST DUCT DOWN TO FUME HOOD. RE: 2/M-902 FOR DETAILS.
4. EXHAUST DUCT DOWN TO HYDROGEN CABINET. TRANSITION TO 6" AT CABINET CONNECTION. BALANCE TO 250 CFM.
5. LAB CONTROL PANEL MOUNTED TO WALL ABOVE CEILING. PROVIDE 120V/1 POWER. COORDINATE WITH DIV. 26.
LABORATORIES WILL HAVE A MINIMUM 8 AIR CHANGES PER HOUR WHICH OCCURS FOR LABORATORIES, EACH WITH ITS OWN LE AND GE TERMINAL.

THE SYSTEM SHALL INCREASE FLOW AT THE GENERAL EXHAUST VALVE UNDER THE CONDITIONS SHOWN ADDITIONAL EXHAUST IS REQUIRED TO MAINTAIN THE ROOM PRESSURIZATION BALANCE PLAN.

INDEPENDENT OF THE EXHAUST VOLUME MAGNITUDE, AND SHALL REPRESENT THE VOLUME OF AIR THAT WILL ENTER THE ROOM TOTAL EXHAUSTS (GENERAL AND FUME HOODS, AS APPLICABLE) AND THE MAKEUP/SUPPLY AIR VOLUME. THIS OFFSET SHALL BE DETERMINED BY THE DESIGNER AND PUBLISHED IN THE BALANCE PLAN.

FOR HOODS WITH CONSTANT VOLUME HOODS OR EQUIPMENT, THE EXHAUST VALVE SHALL MAINTAIN THE SCHEDULED CFM. NON-LABORATORY AREAS SHALL NOT BE CONSIDERED IN THE DETERMINATION OF THE SCHEDULED EXHAUST CFM.

THE SYSTEM SHALL ALLOW A PREPROGRAMMED AND ADJUSTABLE INHIBIT POINT BLOW FOR EACH FUME HOOD.

THE DDC SYSTEM SHALL ALLOW FOR ANY ADDITIONAL POINTS REQUIRED.

THE SYSTEM SHALL ALLOW A PREPROGRAMMED AND ADJUSTABLE INHIBIT POINT BLOW FOR EACH FUME HOOD.

THE SYSTEM SHALL ALLOW FOR ANY ADDITIONAL POINTS REQUIRED.
1. TYPICAL ONE & TWO SIDED RECTANGULAR DUCT TRANSITION DETAIL

2. CHEMICAL FUME HOOD CONNECTION DETAIL

3. CANOPY HOOD DETAIL

4. DUCT COLLAR AT FUME HOOD DETAIL

5. PHOENIX LAB AND GENERAL EXHAUST VALVE CONNECTION DETAIL

6. PHOENIX LAB SUPPLY VALVE CONNECTION DETAIL

NOTES:
1. PROVIDE THE TYPICAL DETAIL TO BE EXECUTED BY FERNCO, INC.
2. SUPPORT LAB SUPPLY VALVE INDEPENDENTLY FROM DUCTWORK.
3. INSULATE HEATING COIL AND TUBE ENDS SAME AS ADJACENT DUCTWORK.
4. REFER TO COIL PIPING DETAILS.
5. PROVIDE 18" ACCESS TO CONTROL PANEL.
6. PROVIDE PIPE TYPE GASKET EQUAL TO SEALEX BY THERMOSEAL INC.
7. SUPPORT LAB SUPPLY VALVE INDEPENDENTLY FROM DUCTWORK.
8. INSULATE HEATING COIL AND TUBE ENDS SAME AS ADJACENT DUCTWORK.
9. REFER TO COIL PIPING DETAILS.
10. PROVIDE 18" ACCESS TO CONTROL PANEL.

NOTE: OUTLETS, ETC. UTILITIES AT EACH HOOD TO ALLOW ACCESS AT ALL VALVES, OUTLETS, ETC.
LEVEL 3 PLUMBING ENLARGED PLAN - DEMOLITION

1. REMOVE EXISTING FLOOR DRAIN AND ASSOCIATED PIPING BACK TO MAIN AND CAP.

2. REMOVE EXISTING SANITARY VENT LINE FOR FLOOR DRAIN.

3. REMOVE EXISTING SANITARY VENT LINE FOR FLOOR DRAIN. TO BE REWORKED IN RENOVATION PACKAGE.

PD-301

University of North Texas - Chemistry Building
Chemistry 3rd Floor Welch Chair Laboratory Renovation

211 North Record St., Suite 450
Dallas, TX 75202
Office: 214.310.1018
Fax: 214.310.1042
www.TreanorHL.com
GENERAL NOTES

1. PRIOR TO WORK CONTRACTOR SHALL COORDINATE PLUMBING WORK WITH OTHER TRADES.
2. PROVIDE A SUMP DOWNSTREAM FROM EACH PUMPED VALVE.
3. PROVIDE A SEPARATE P-TRAP AT EACH PLUMBING FIXTURE. UNLESS TRAP IS BUILT INTO FIXTURE.
4. REFER TO ARCHITECTURAL DRAWINGS FOR PLUMBING FIXTURE MOUNTING HEIGHTS.
5. MAKE ROUGH IN AND FINAL CONNECTION TO ALL PLUMBING FIXTURES.
6. ALL NEW WORK SHALL CONFORM TO THE 2018 EDITION OF THE INTERNATIONAL PLUMBING CODE UNLESS OTHERWISE INDICATED OR SHOWN.
7. DRAINAGE AREAS ENVIRONMENTAL IN NATURE. NOT ALL REQUIRED PIPING SHOWN. LINISH CONTRACTOR SHALL PROVIDE A COMPLETE WORKING PLUMBING SYSTEM PER THE DRAWINGS.
8. PROVIDE EXISTING SPRINKLER SYSTEM IN ACCORDANCE WITH 2016 EDITION OF NFPA 13 REQUIREMENTS.
9. FIRE PROTECTION PIPES SHALL BE COORDINATED AND SHOWN ON OTHER TRADES, SUCH AS PLUMBING, HVAC AND ELECTRICAL.
10. REFER TO REFLECTED CEILING PLANS TO COORDINATE FIRE SPRINKLER HEAD LAYOUT.
11. PROVIDE A SEPARATE CONNECTION TO DOMESTIC HOT WATER SUPPLY TO EACH VACUUM BREAKER OR BACKFLOW PREVENTER. USE ISOLATION VALVES FOR EACH SINGLE PLUMBING FIXTURE, OR WHERE FIXTURES ARE GROUPED (AS INDICATED ON FLOOR PLANS) ON THE DOMESTIC WATER SUPPLY LINES TO LAB EQUIPMENT.
12. CONTRACTOR SHALL OBTAIN ARCHITECT/ENGINEER APPROVAL FOR ALL ACCESS PANEL LOCATIONS.
13. PROVIDE AN ISOLATION VALVE FOR EACH SINGLE PIPING FIXTURE, OR WHERE FIXTURES ARE GROUPED USE ISOLATION VALVE PER GROUP, REFER TO FLOOR PLANS.
14. PLUMBING WITHOUT CEILINGS WHERE DUCTWORK IS OVER 48" WIDE, PROVIDE SPRINKLERS BOTH ABOVE AND BELOW THE DUCTWORK.
15. PROVIDE "PROSET" TRAP GUARD FOR EACH FLOOR DRAIN, TRENCH DRAIN AND FLOOR SINK, UNLESS OTHERWISE INDICATED.

SHOCK ARRESTOR SCHEDULE

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NOTE: TABLE CHROMING PER DRAWING FOR LABORATORY, CO2 GAS, AND FUME HOODS. SCHEDULE ABOVE.

UNIVERSITY OF NORTH TEXAS - CHEMISTRY BUILDING
CHEMISTRY 3RD FLOOR WELCH CHAIR
LABORATORY RENOVATION

[Plumbing Legend and Schedule]
KEYED NOTES - P-301

1. 3/4" LA CONNECT NEW 1" LA TO EXISTING COMPRESSED AIR SERVICE ABOVE CEILING.

2. 1 1/2" DCW AND DHW, 1" DIS AND DIR DOWN IN PIPE CHASE TO LAB SINK AND DI FAUCET. 2" LW DOWN WITH 2" VENT.

3. 1" LA DOWN TO FUME HOODS. 2" LW DOWN WITH 2" LV UP ABOVE CEILING.

4. 1" DCW AND DHW TO ASSE 1071 COMPLIANT THERMOSTATIC MIXING VALVE ABOVE CEILING FOR EMERGENCY SHOWER. ROUTE 1 1/4" TEMPERED WATER LINE DOWN TO FIXTURE WATER CONNECTION.

5. 1 1/2" DCW DOWN TO FUME HOODS. 2" LW DOWN WITH 2" LV UP ABOVE CEILING.

6. 3/4" LA CONNECT LAB 1/2" LA TO LAB SINK. 2" LW DOWN WITH 2" VENT.

7. 1" LA DOWN TO FUME HOODS. 2" LW DOWN WITH 2" VENT.

8. 2" SANITARY VENT FROM BELOW.

9. 1/2" DCW AND DHW DOWN TO LAB SINK. 2" LAB WASTE DOWN WITH 2" LAB VENT. 1" DIS LOOP DOWN IN WALL BEHIND SINK. ROUGH-IN AND CONNECT 1/2" DIS TO SINK DI FAUCET.

10. PROVIDE CONNECTION FROM FIRE SPRINKLER SYSTEM TO SPRINKLER HEAD INSIDE GAS CABINET.

11. PROVIDE CONNECTION FROM FIRE SPRINKLER SYSTEM TO SPRINKLER HEAD INSIDE GAS CABINET.
1. Pipe Penetration Thru Existing Slab

2. Typical Pipe Support Detail

3. RO Water Piping to Sink Connection

4. Pipe Penetration Thru Non-Rated Wall

5. Pipe Penetration Thru Fire-Rated Wall

6. Sprinkler Head in Ceiling Detail

7. Sprinkler in Ceiling Detail

Note: Install sprinkler head in exact center of lay-in ceiling tiles. This detail applies to all locations where sprinkler heads are installed in suspended ceilings. Insulation (where specified) pack with fibrous material. All around.
GENERAL NOTES - GD010
A. LIGHT COLOR INDICATES EXISTING MATERIAL COLOR CODE INDICATES NEW MATERIAL.
B. PROVIDE SEPARATE NEUTRAL CONNECTION TO PANEL BUS DUCT. NO SHARED NEUTRAL.
C. LABEL LIGHT SWITCHES WITH THE PANEL AND CIRCUIT NUMBER SERVING THE LIGHTS.

PARTIAL NORMAL ONE-LINE DIAGRAM - DEMO

PARTIAL EMERGENCY ONE-LINE DIAGRAM - DEMO

KEYED NOTES - ED010
1. COMPLETE INSTALLATION OF ALL EQUIPMENT SHOWN WILL BE COMPLETE AS SHOWN.
2. DRAWN TO SCALE.
3. COMPLETE INSTALLATION OF ALL EQUIPMENT SHOWN WILL BE COMPLETE AS SHOWN.
4. DRAWN TO SCALE.
GENERAL NOTES - GD104

A. REFER TO ARCHITECTURAL DEMOLITION DRAWINGS FOR DESCRIPTION OF
DEMOLITION IN EACH AREA.

B. FIELD VERIFY EXISTING CONDITIONS PRIOR TO DISCONNECTING AND
REMOVING ELECTRICAL EQUIPMENT. REMOVE BRANCH CIRCUIT BACK TO
NEAREST JUNCTION BOX SCHEDULED TO REMAIN.

C. REMOVE METER BRANCH CIRCUITS FROM METER PANEL TO DISCONNECT,
REMOVING METER BRANCH CIRCUITS FROM METER PANEL TO
DISCONNECT.

D. REMOVE MOTOR BRANCH CIRCUITS FROM MOTOR BACK TO DISCONNECT.
LOCK OUT DISCONNECT AND PROVIDE WARNING LABEL AT SOURCE PANEL.

E. REMOVE WIRING DEVICES. REMOVE BRANCH CIRCUIT BACK TO PANELBOARD.

F. REMOVE FIRE ALARM DEVICES AND REMOVE WIRING BACK TO NEAREST
JUNCTION BOX.

G. PROVIDE DUST COVERS FOR SMOKE DETECTORS SCHEDULED TO REMAIN.

H. MAINTAIN ELECTRICAL SERVICE TO AREAS OUTSIDE SCOPE OF WORK.

I. REFER TO SPECIFICATIONS SECTION 26-00-01 "DEMOLITION" FOR ADDITIONAL REQUIREMENTS.

KEYED NOTES - ED104

1. EXISTING PANEL TO BE REMOVED AND REPLACED.

2. DISCONNECT EXISTING BRANCH CIRCUITS FROM PANELBOARD. REMOVE EXISTING CONDUIT AND WIRING AND DISPOSE.

3. DISCONNECT EXISTING LIGHT FIXTURES AND REMOVE. RE-USE EXISTING LIGHTING CIRCUIT TO SERVE NEW LIGHTS. RETURN LIGHT FixtureS TO OWNER. EXISTING LIGHTS TO REMAIN DURING DEMOLITION.

4. DISCONNECT EXISTING LIGHTS ON EMERGENCY POWER AND RETURN TO OWNER. RE-USE EXISTING EMERGENCY CIRCUIT TO SERVE NEW EMERGENCY LIGHTS. EXISTING LIGHTS TO REMAIN DURING DEMOLITION.

5. DISCONNECT AND REMOVE ALL EXISTING PLUG MOLDS. RETURN TO OWNER.

6. REMOVE EXISTING FLOOR BOXES. REPAIR, PATCH AND FINISH EXISTING FLOOR. REMOVE ASSOCIATED CONDUIT AND WIRING BACK TO PANELBOARD AND DISPOSE.

REVISIONS

NO DESCRIPTION DATE

12-17-2020

1/4" = 1'-0"
6

5

4

3

2

1

Feed ThrougYESh: No
Sub-Feed: No
Neutral Rating: 100.00%

Enclosure: Type 1

Location: ELEC RM 337
Supply...
Mounting: Surface

Volts: 120/208 Wye
Phases: 3
A.I.C.... 10,000

Bus Rating: 100A
MCB: 100A
MLO:

SAM ELHAJ

Feed Through: NO
Sub-Feed: No
Neutral Rating: 100.00%

83255
L IC
E N S ED I
ES
G
S IO
NA L E N

Enclosure: Type 1

R

Bus Rating: 200A
MCB: 100A
MLO:

Project

OF

27"

Volts: 120/208 Wye
Phases: 3
A.I.C.... 10000

Chemistry

PR

Location: LAB 334B
Supply... 3LDP
Mounting: Recessed

Panel: 3EL

Project

EE

Chemistry

E O F TEX
A

N

Panel: 3LL7

AT

S

28"

ST

Tx. Registration # F-2113

12-17-2020

E

26"

Wires & Conduit

Notes: EXISTING
Ckt
No.

Circuit Description

Trip

A

Poles

2#12, #12, 3/4"C

1

RECEPTACLE RM INSTRU 330 20 A

1

2#12, #12, 3/4"C

3

RECEPTACLE RM INSTRU 330 20 A

1

2#12, #12G, 3/4"C

5

RECEPTACLE ALCOVE 331

20 A

1

2#12, #12G, 3/4"C

7

RCPT RM INSTRU 330

20 A

1

2#12, #12G, 3/4"C

9

RCPT RM INSTRU 330

20 A

1

2#12, #12G, 3/4"C

11

RCPTS LABORATORY 334

20 A

1

2#12, #12G, 3/4"C

13

RCPTS BOTTOM RIGHT RM
330

20 A

1

2#12, #12G, 3/4"C

15

RCPTS BOTTOM LEFT RM 330 20 A

1

2#12, #12G, 3/4"C

17

RCPTS TOP LEFT RM 330

20 A

1

2#12, #12G, 3/4"C

19

RCPTS TOP RIGHT RM 330

20 A

1

2#12, #12G, 3/4"C

21

CENTRIFUGE RM INSTRU 330

20 A

1

2#12, #12G, 3/4"C

23

RCPT RM ALCOVE 331

20 A

1

2#12, #12G, 3/4"C

25

RCPTS LAB TOP LEFT 334

20 A

1

2#12, #12G, 3/4"C

27

RCPTS LAB TOP LEFT 334

20 A

1

2#12, #12G, 3/4"C

29

RCPTS LAB TOP MIDDLE 334

20 A

1

2#12, #12G, 3/4"C

31

RCPTS LAB TOP MIDDLE 334

20 A

1

2#12, #12G, 3/4"C

33

RCPTS LAB TOP RIGHT 334

20 A

1

B

500 VA / 1265 VA
500 VA / 1265 VA
500 VA / 1265
VA

25"

24"

C

180 VA / 1265 VA
180 VA / 500 VA
660 VA / 500 VA
900 VA / 1000 VA
900 VA / 1000 VA
720 VA / 1160
VA

23"
720 VA / 1000 VA
1300 VA / 1000
VA

180 VA / 180 VA

Circuit Description

Ckt
No.

Trip

Trip

Poles

1

20 A

OVEN LABORATORY 334

2

2#12, #12G, 3/4"C

1

EXISTING CIRCUIT

20 A

1

1

20 A

OVEN LABORATORY 334

4

2#12, #12G, 3/4"C

3

EXISTING CIRCUIT

20 A

1

1

20 A

OVEN LABORATORY 334

6

2#12, #12G, 3/4"C

5

EXISTING CIRCUIT

20 A

1

1

20 A

OVEN LABORATORY 334

8

2#12, #12G, 3/4"C

7

EXISTING CIRCUIT

20 A

1

1

20 A

FUME HOOD RM INSTRU 330

10

2#12, #12G, 3/4"C

9

EXISTING CIRCUIT

20 A

1

1

20 A

RCPT LABORATORY 334

12

2#12, #12G, 3/4"C

11

EXISTING CIRCUIT

20 A

1

1

20 A

14

2#12, #12G, 3/4"C

13

EXISTING CIRCUIT

20 A

1

1

20 A

16

2#12, #12G, 3/4"C

15

EXISTING CIRCUIT

20 A

1

1

20 A

RCPTS LAB SUPPORT 334

18

2#12, #12G, 3/4"C

17

EXISTING CIRCUIT

20 A

1

1

20 A

RCPT LAB SUPPORT 334

20

2#12, #12G, 3/4"C

19

EXISTING CIRCUIT

20 A

1

1

20 A

FUME HOOD LAB SUPPORT
334

22

2#12, #12G, 3/4"C

21

EXISTING CIRCUIT

20 A

1

1

20 A

RCPT LAB SUPPORT 334

24

2#12, #12G, 3/4"C

23

EXISTING CIRCUIT

20 A

1

1

20 A

RCPT ALCOVE 331

26

2#12, #12G, 3/4"C

25

EXISTING CIRCUIT

20 A

1

1

20 A

DESK RCPTS SHRD OFC 333

28

2#12, #12G, 3/4"C

27

REFRIGERATOR RM ALCOVE
335

20 A

1

1

20 A

DESK RCPTS SHRD OFC 333

30

2#12, #12G, 3/4"C

29

EXISTING CIRCUIT

20 A

1

1

20 A

RCPTS INSTRU 330

32

2#12, #12G, 3/4"C

31

EXISTING CIRCUIT

20 A

1

1

20 A

RCPTS CORRIDOR
LABORATORY 334

34

2#12, #12G, 3/4"C

33

EXISTING CIRCUIT

20 A

1

FUME HOOD LAB SUPPORT
334
FUME HOOD LAB SUPPORT
334

Wires & Conduit

Wires & Conduit

Ckt
No.

Poles

Circuit Description

A

B

C

0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA
0 VA / 0 VA

Circuit Description

Ckt
No.

Poles

Trip

1

20 A

EXISTING CIRCUIT

2

1

20 A

EXISTING CIRCUIT

4

1

20 A

EXISTING CIRCUIT

6

1

20 A

EXISTING CIRCUIT

8

1

20 A

EXISTING CIRCUIT

10

1

20 A

EXISTING CIRCUIT

12

1

20 A

EXISTING CIRCUIT

14

1

20 A

EXISTING CIRCUIT

16

1

20 A

EXISTING CIRCUIT

18

1

20 A

EXISTING CIRCUIT

20

1

20 A

EXISTING CIRCUIT

22

1

20 A

EXISTING CIRCUIT

24

1

20 A

EXISTING CIRCUIT

26

1

20 A

EXISTING CIRCUIT

28

1

20 A

EXISTING CIRCUIT

30

1

20 A

EXISTING CIRCUIT

32

1

20 A

EXISTING CIRCUIT

34

1

20 A

REFRIGERATOR RM ALCOVE
335

36

1

20 A

EXISTING CIRCUIT

38

1

20 A

EXISTING CIRCUIT

40

1

20 A

EXISTING CIRCUIT

42

E

Wires & Conduit

211 North Record St., Suite 450
Dallas, TX 75202
Office: 214.310.1018
Fax: 214.310.1042
www.TreanorHL.com

Notes:

22"
720 VA / 180 VA
720 VA / 540 VA
720 VA / 360 VA

2#12, #12, 3/4"C

0 VA / 0 VA
800 VA / 0 VA
0 VA / 0 VA

21"

2#12, #12G, 3/4"C

35

RCPTS LAB TOP RIGHT 334

20 A

1

2#12, #12G, 3/4"C

37

RCPTS LAB RIGHT WALL 334

20 A

1

2#12, #12G, 3/4"C

39

RCPTS LAB BOTTOM 334

20 A

1

2#12, #12G, 3/4"C

41

WATER POLISHER LAB 334

20 A

1

2#12, #12G, 3/4"C

43

PRINTER RM SHRD OFC 333

20 A

1

2#12, #12G, 3/4"C

45

GAS SORPTION RM 330

20 A

1

2#12, #12G, 3/4"C

47

GAS SORPTION RM 330

20 A

1

2#12, #12G, 3/4"C

49

DEGRASSING RM 330

20 A

1

2#12, #12G, 3/4"C

51

OVEN RM LAB 334

20 A

1

2#12, #12G, 3/4"C

53

DESK RCPTS SHRD OFC 333

20 A

1

2#12, #12G, 3/4"C

55

DESK RCPTS SHRD OFC 333

20 A

1

2#12, #12G, 3/4"C

57

LRC CONTROLS

20 A

1

59

SPARE

20 A

1

720 VA / 500 VA

0 VA / 0 VA

D

1

20 A

VV BOXES

36

2#12, #12G, 3/4"C

35

EXISTING CIRCUIT

20 A

1

1

20 A

RCPTS LAB SUPPORT 334

38

2#12, #12G, 3/4"C

37

EXISTING CIRCUIT

20 A

1

1

20 A

RCPT LAB SUPPORT 334

40

2#12, #12G, 3/4"C

39

EXISTING CIRCUIT

20 A

1

1

20 A

RCPTS LAB SUPPORT 334

42

2#12, #12G, 3/4"C

41

EXISTING CIRCUIT

20 A

1

1

20 A

OVEN LABORATORY 334

44

2#12, #12G, 3/4"C

1

20 A

OVEN LABORATORY 334

46

2#12, #12G, 3/4"C

1

20 A

OVEN LABORATORY 334

48

2#12, #12G, 3/4"C

0 VA / 800 VA

20"
360 VA / 1160 VA
1720 VA / 1000
VA
180 VA / 360 VA

19"

18"

500 VA / 1265 VA
360 VA / 1265 VA
1500 VA / 1265
VA
1320 VA / 1684
VA

Total Load:
Total Amps:

1265 VA / 1684
VA

Load Classification
RECEPTACLES

3

CHILLER RM 330

52

360 VA / 1733 VA

Connected Load
1600 VA

0 VA
0A

800 VA
8A

800 VA
8A

Demand Factor
100.00%

Estimated Demand
1600 VA

3

30 A

HEATER RM 330

58

0 VA / 1733 VA

18872 VA
161 A

Demand Factor
59.78%

Panel Totals
Total Conn. Load:
Total Est. Demand:
Total Conn. Current:
Total Est. Demand Current:

3#10 #10G, 3/4"C

1600 VA
1600 VA
4A
4A

Notes:

56
500 VA / 1733 VA

Connected Load
51111 VA

Load Classification
RECEPTACLES

0 VA / 0 VA

54

3#10 #10G, 3/4"C

60

14547 VA
121 A
Estimated Demand
30556 VA

15"

Panel Totals
Total Conn. Load:
Total Est. Demand:
Total Conn. Current:
Total Est. Demand Current:

C

14"

25 A

360 VA / 1684
VA

17692 VA
151 A

Total Load:
Total Amps:

0 VA / 0 VA

50

17"

16"

0 VA / 0 VA

2#12, #12, 3/4"C

51111 VA
30556 VA
142 A
85 A

Notes:

13"

12"

11"

10"

9"
B

BIM 360://ST0569.2001.00 DR. Ma Chemistry Lab Renovation/1192-010-01_Elec_R20.rvt

8"

Chemistry 3rd Floor Welch Chair
Laboratory Renovation

720 VA / 720 VA

D

0 VA / 0 VA

University of North Texas - Chemistry Building

720 VA / 860 VA

B

7"

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6"

5"

For: ISSUED FOR CONSTRUCTION
12/18/2020

Date:
REVISIONS

4"

A

NO

DESCRIPTION

DATE

3"

A

2"

12/17/2020 1:19:55 PM

C

PANELBOARD LEGEND

3LL7

1"

E-701

3EL
ELECTRICAL
PANELBOARD
SCHEDULES
TreanorHL NO.

6

5

4

3

2

1

ST0569.2001.00

