UNIVERSITY OF WASHINGTON

Project No. 207229
May 03, 2021

PROJECT MANUAL
Volume I
Divisions 0 - 28

Architects

buffalodesign
architecture I interiors
1520 fourth avenue suite 400
seattle, wa 98101

Mechanical Engineers
Electrical Engineers
Fire Protection Engineers

Sazan Group
600 Stewart Street, suite 1400
Seattle, WA 98101
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REQUEST FOR BIDS

University of Washington
UWMC IT EDS Office Space
Date of Bid Opening: June 9, 2021

Bid Submittal: The University of Washington is taking precautions to limit exposure and impacts related to COVID-19. To comply with the Governor’s “Safe Start” plan, the requirement to submit a sealed bid is waived. Bids will be received by the University of Washington, Project Delivery Group, by email at PDGbids@uw.edu.

The Bid Form will be received up to 3:00 p.m. on Wednesday, June 9, 2021. Bids will then be publicly opened and read aloud. Bids received after the date and hour above stated will not receive consideration.

COVID Option: The Bid Form will be received up to 3:00 p.m. on Wednesday, June 9, 2021 Bids will then be publicly opened and read aloud via Zoom Version 5.0 (required) The meeting will be held via the link of: https://washington.zoom.us/j/92167956933. Bids received after the date and hour above stated will not receive consideration. Attendance in person is not allowed.

Only bidders who are on the Critical Patient Care Rosters A & B at the time of bid receipt may bid on this project. Bids will be received by the University of Washington at the above mentioned time and place.

Project Description:

The project includes the following work: Interior renovation of the former Data Center in the UW Surgery Pavilion, first floor. Selective demolition of existing partitions, New partitions and drywall; New suspended acoustical ceiling; New and relocated hollow metal and wood doors, New hardware; New Norateile flooring, New resilient base; Prep and paint all new and existing walls; New lighting, Add convenience power for office and pharmacy refrigerators; Rough in for Owner furnished data connections; Modification of existing HVAC system and controls; Modification of existing fire sprinkler system. This is unoccupied space and is on a non-patient care floor. 2,333 square feet.

All construction operations must comply with the most current Covid 19 related rules and guidance from the Governor’s Office. All activities must also comply with all related and applicable requirements issued by the Washington State Department of Labor and Industries and Public Health Agencies having jurisdiction.

Questions: Questions about this project should be directed to:

A/E Name: Buffalo Design
Contact Person: Louise Wackerman, Project Architect
Phone Number: 206 467 6306

Pre-Bid Site Meeting: A virtual pre-bid site walk meeting will be available to prospective bidders. Attendance in person is not allowed. The virtual pre-bid meeting will occur on May 20, 2021 starting at
10:00am. Prospective bidders may join the meeting via the link below: https://washington.zoom.us/j/94907718102.

This will be the only opportunity for bidders to view the Project site.

**Bid Documents:** Bidders may obtain or access plans, specifications, and addenda for this project at https://facilities.uw.edu/projects/business-opportunities/solicitations. Contractors who would like to be included on the Planholder's list shall either attend a pre-bid meeting or request to be added by emailing PDGbids@uw.edu.

**Bid Guarantee:** A surety company bid bond on a form acceptable to Owner, a cashier's check or a certified check payable to the order of University of Washington, or cash, shall accompany each bid in an amount not less than five percent (5%) of the Base Bid. No bidder may withdraw its bid after the hour set for the opening thereof, unless the award of the contract is delayed for a period exceeding 60 days.

**BUSINESS EQUITY:** The University of Washington is committed to providing optimal opportunity for participation in contracting by **Business Equity Enterprises (BEE).** The University of Washington defines a **Business Equity Enterprise (BEE)** as "any entity licensed to do business in the State of Washington, including a corporation, partnership, sole proprietorship, or other legal entity that meets any of the following:"

**Certified Business Enterprise (CBE):** Any business enterprise certified with the Washington State Office of Minority and Women’s Business Enterprises.

**Lesbian/Gay/Bisexual/Transgender Business Enterprise (LGBTBE):** More than 50% owned and controlled by at least one person who is a member of the LGBT community.

**Minority Business Enterprise (MBE):** More than 50% owned and controlled by at least one person who is a member of one or more of the following minority groups:
- Asian Pacific American
- Black American
- Hispanic American
- Native American
- Subcontinent Asian American

**Minority Women’s Business Enterprise (MWBE):** More than 50% owned and controlled by at least one woman who is a member of one or more of the above minority groups.

**Small Business Enterprise (SBE):** A business entity that:
- Can attest that it is owned and operated independently from all other businesses and
- Conforms to the U.S. Small Business Administration Size Standards of the North American Industry Classification System (NAICS) Codes in which it is to be engaged at the UW; or
- Is certified with the OMWBE.

**Veteran’s Business Enterprise (VBE):** Certified with the Washington State Department of Veteran’s Affairs (DVA)

**Women’s Business Enterprise (WBE):** More than 50% owned and controlled by one or more women. The University of Washington has determined that an overall aspirational goal of 20% Business Equity Enterprise (BEE) utilization, inclusive of 15% minority and women-owned business utilization, is practicable and attainable on this construction project; that goal is negotiable based upon the specialized nature of the work and the relative availability of BEE to perform the specific work scopes identified in this project. **The University of Washington welcomes the participation of all BEE, irrespective of gross revenues, including those that are self-designated and those that are state (OMWBE) certified.**
Participation may be on a direct basis in response to this invitation to bid, or as a subcontractor or supplier.

**Safety Plans:** Prior to the issuance of the Notice to Proceed, the Contractor will be required to submit to the Owner a copy of its company safety program. See Modifications to the General Conditions, Part 5 for details.

The Owner reserves the right to reject any or all bids and to waive as an informality any irregularities in the bids received.
00 21 00 INSTRUCTIONS FOR BIDDERS

1. CONTRACTOR'S REGISTRATION

   All bidders must be registered by the Washington State Department of Labor and Industries in accordance with R.C.W. 18.27.020.

2. SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK

   A. Bidder acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the Work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the Work or its cost.

   B. Not used

   C. Bidder acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by Owner, as well as from the drawings and specifications made a part of these Contract Documents.

   D. Bidder acknowledges that adjoining areas will be conducting normal operations during the work. Bidder should anticipate pedestrian and traffic congestion, limited parking, and the requirement that the work be coordinated with ongoing operations.

   E. Bidder acknowledges that its bid is based upon a schedule and assumptions which incorporate these conditions.

   F. Owner assumes no responsibility for any conclusions or interpretations made by bidder based on the information made available by Owner. Should a bidder find discrepancies or omissions in the drawings or specifications, or should bidder be in doubt as to their meaning, bidder shall at once notify the Owner. If appropriate, Owner will send written instructions to all bidders by addenda. Questions received less than 10 days before the time of bid opening may not be answered. All addenda issued shall be incorporated into these Contract Documents.

3. PREPARATION OF BIDS

   Bidder shall comply with the following instructions in preparing its bid.

   A. The name, address, and Contractor's license number of bidder shall be typed or printed on the bid in the space provided.

      Bids must be (1) submitted on the forms furnished by Owner or on copies of those forms, and (2) manually signed in ink.

   B. Bidders shall submit bids in the format provided in the Bid Form. Only the amounts and information asked for in the Bid Form furnished will be considered as the bid. All blank spaces must be filled in.

   C. Bidder shall bid upon all alternates indicated in the Bid Form. When bidding on alternates for which there is no charge, bidder shall write the words "No Charge" in the space provided on the Bid Form. If a bidder fails to bid an alternate, or notes "no bid," it will be construed as meaning that there will be no change in the Contract Sum and that the alternate is included in the contract Sum. Alternate bids will not be considered unless requested in the Bid Form.
D. The cost of trench safety systems for trench excavation that exceeds a depth of four feet must be identified as a lump sum amount on the Bid Form as well as included in the Base Bid amount. The costs of trench safety systems shall not be considered as incidental to any other contract item, and any attempt to include the trench safety systems as an incidental cost is prohibited. Identification of this amount is an acknowledgment that the bidder has considered proper safety provisions in the estimate but does not relieve the bidder of responsibility for full compliance with all laws and statutes regardless of their actual cost. If this project will involve trench excavation in excess of a depth of four feet, bidder must include a lump sum dollar amount. “N/A” and “zero” are not responsive.

E. Bidders shall acknowledge all addenda by identifying the addendum number(s) in the space provided on the Bid Form. Notwithstanding any automatic notification methods utilized by Bidder, Bidder is responsible for checking Owner’s bid posting website for any addenda issued up to and until the bid opening date and time specified in Section 00 11 00.

F. Bidder shall include in the bid all allowances provided in the Bid Form. Owner will pay the difference if the actual cost exceeds the allowance.

4. TAXES

The bid shall include all taxes imposed by law except Washington State Sales Tax. Sales tax shall not be included in the bid price, except that the retail sales tax upon sales and rentals to prime contractors and subcontractors of tools, equipment, and material primarily for use by the Contractor rather than for resale as a component part of the finished structure, shall be included in the bid price. A proportionate amount of State sales tax will be added to each progress payment, collected from Owner, and paid to the State by Contractor.

5. BID GUARANTEE

Bidder shall furnish a bid guarantee in the form of a firm commitment, such as bid bond, postal money order, cash or cashier's check payable to Owner, in the amount of at least 5% of the base bid. Owner reserves the right to hold the bid guarantees of all bidders until the successful bidder has entered into the contract and furnished the required bonds and insurance certificates, or for a period of 60 days, whichever is the shorter time.

6. FILING FEES

Applicable state laws concerning prevailing wages, hours, workers’ compensation and other conditions of employment are called to the attention of bidders for their compliance. Bidder shall include in the bid any filing fees required to comply with applicable labor laws.

7. SPECIFIED PRODUCTS

Bids must be based upon use of items named in the specifications, or approved equals or substitutions. In certain cases, specific items have been named because of operational or maintenance considerations; approval of equals or substitutions should not be assumed.

Requests for approval of equals or substitutions must be made in writing and received by the A/E at least 10 days prior to the date of bid opening. Said request must include complete descriptions, technical data, and performance records. Any approval of the proposed equal or substitution will be made by addendum issued to all bidders. See Section 01 25 00, Substitution Procedures, for instructions.
8. SUBMISSION AND WITHDRAWAL OF BIDS

A. Bids and bid modifications shall be submitted as directed in the request for bids.

B. Bids may be modified if in writing and received before bid opening time.

C. A bidder may withdraw its bid by submitting a written request before the bid opening time. Owner will return the bid unopened after Contract award.

9. LATE SUBMISSIONS

A. Any bid, bid modification or request to withdraw a bid which is received after bid opening time will not be considered.

10. BID EVALUATION

Bids which are incomplete, or which are conditioned in any way, or which contain erasures, alterations, or items not called for in the Bid Form, or which are not in conformity with the law or with these Instructions, shall be rejected as nonresponsive if the irregularity is material and may be rejected as nonresponsive if the irregularity is not material.

Owner reserves the right to reject any or all bids and to waive any informalities or nonmaterial irregularities in the bids received.

The determination of the low responsive bid shall be made by Owner based upon any combination of the base bid and alternates which, in Owner's sole discretion, is in Owner's best interest considering price, schedule and other factors. The numbering of the alternates in the Bid Form bears no relationship to the order in which the alternates may be selected by Owner.

In accordance with RCW 39.04.380, for a public works bid received from a nonresident contractor from a state that provides an in-state percentage bidding preference, a Comparable Percentage Disadvantage (CPD) will be applied to the bid of that nonresident contractor. The CPD is the percent advantage provided by the nonresident contractor's home state. For the purpose of determining the successful bidder, Owner will multiply the nonresident contractor bid amount by the CPD. The “bid amount” shall be the total of the base bid and all accepted alternate bid items. The CPD shall be added to the nonresident contractor bid amount to establish the Nonresident Disadvantage Total. The Nonresident Disadvantage Total shall be compared to the Washington state contractor bid amounts.

See example below:

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<th>Alaska Nonresident Contractor Bid Amount</th>
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<tr>
<td>Multiplied by the Alaska CPD</td>
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<th>Alaska Nonresident Contractor Bid Amount</th>
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If the Nonresident Disadvantage Total is lower than all other Washington contractor bid amounts, the Alaska nonresident contractor is the low bidder and will be awarded a contract for the bid amount of $100,000, provided that they are determined to be a responsive and responsible bidder.

If the Nonresident Disadvantage Total is higher than a Washington contractor bid amount, the Washington bidder will be awarded a contract for the bid amount, provided that they are determined to be a responsive and responsible bidder.

11. LOW RESPONSIBLE BIDDER

A. It is the intent of Owner to award a contract to the low responsible bidder. Before award, the bidder must meet the following bidder responsibility criteria to be considered a responsible bidder. The bidder may be required by the Owner to submit documentation demonstrating compliance with the criteria. The bidder must:

1. Have a current certificate of registration in compliance with chapter 18.27 RCW, which must have been in effect at the time of bid submittal;
2. Have a current Washington Unified Business Identifier (UBI) number;
3. If applicable:
   a. Have Industrial Insurance (workers’ compensation) coverage for the bidder’s employees working in Washington, as required in Title 51 RCW;
   b. Have a Washington Employment Security Department number, as required in Title 50 RCW;
   c. Have a Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3); and
5. If applicable, provide evidence of the required contractor training from Washington State Department of Labor & Industry. Chapter 39.04.350 and 39.06.020 RCW.

6. Within the three-year period immediately preceding the date of the bid solicitation, not have been determined by a final and binding citation and notice of assessment issued by the Washington Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of Chapter 49.46, 49.48, or 49.52 RCW.

B. In addition to the bidder responsibility criteria above, the bidder must also meet the following relevant supplemental bidder responsibility criteria applicable to the project:

1. Performance Evaluations: The Bidder shall not have received one or more overall evaluations of “Deficient” or “Inadequate” as part of the Owner’s Contractor Performance Evaluation Program.
2. Debarment by Owner: The Bidder shall not be currently debarred by the Owner from contracting with the Owner for having received overall evaluations of their performance of “Deficient” or “Inadequate” on three or more projects of the Owner physically completed during the preceding five (5) year period.
C. As evidence that the bidder meets the bidder responsibility criteria in paragraph B above, the apparent low bidder must submit documentation as may be required below to the Owner within 48 hours of the bid submittal deadline. The Owner reserves the right to request such documentation from other bidders also.

1. **Performance Evaluations:** The Owner shall use its own records of the Bidder’s Performance Evaluation Reports on previous projects to evaluate the Bidder’s compliance with this criterion. The bidder is not required to submit any documentation for this item, unless the bidder has information different from the Owner’s records.

2. **Debarment by Owner:** The Owner shall use its own records of debarment to evaluate the Bidder’s compliance with this criterion. The bidder is not required to submit any documentation for this item, unless the bidder has information different from the Owner’s records.

D. If the Owner determines the bidder does not meet the bidder responsibility criteria in paragraph B above and is therefore not a responsible bidder, the Owner shall notify the bidder in writing with the reasons for its determination. If the bidder disagrees with this determination, it may appeal the determination within 24 hours of receipt of the Owner’s determination by presenting additional information to the Owner. The Owner will consider the additional information before issuing its final determination. If the final determination affirms that the bidder is not responsible, the Owner will not execute a contract with any other bidder until two business days after the bidder determined to be not responsible has received the final determination.

12. **CONTRACT AWARD AND EXECUTION**

The formal acceptance by the Owner of the lowest responsive bid of a responsible bidder will be in the form of a notice of award of public works contract issued by the Owner to the bidder. Within 7 days of the notice of award date, bidder shall submit an executed Contract (see Appendix A); certificate of insurance and endorsements as required in the Contract Documents; and Payment and Performance Bonds using AIA Document A312, most current edition, or other form acceptable to Owner, in Contract Award Amount plus Washington State Sales Tax. If the successful bidder, after award of the Contract, fails to execute all Contract Documents or provide insurance documentation and bonds as required within the time specified, Owner may revoke award of the Contract and the bid guarantee may be retained by Owner.

13. **FEDERAL EXCLUSION REQUIREMENTS**

By submitting a bid for this project, Contractor hereby represents and warrants that it is not and at no time has been, excluded, suspended, or barred from participation in, or otherwise sanctioned by any federally funded health care program, including Medicare and Medicaid. Contractor hereby agrees to immediately notify the Owner of any threatened, proposed, or actual exclusion, suspension, or debarment from any federally funded health care program, including Medicare and Medicaid.

Individuals or entities that are excluded by the Office of the Inspector General from working on federally-funded programs will not be permitted to work on this project. If a contractor, including any subcontractors or suppliers, is found to be barred by the OIG, that contractor shall immediately be excluded from the jobsite and the Owner will not be responsible for any damage or delay resulting from such exclusion. Contractor should check the exclusion program of the OIG to verify that neither it nor its subcontractors or suppliers appear on the database. The database may be accessed through the OIG website at: www.oig.hhs.gov. Upon receipt of a notice of award of contract from the Owner, Contractor shall submit a list of subcontractors and suppliers for review by Owner.
14. UNIVERSITY OF WASHINGTON’S CORPORATE COMPLIANCE PLAN

University of Washington’s Medical Center’s Corporate Compliance Plan is designed to ensure that the Hospital complies with federal, state, and local laws and regulations. It focuses on the promotion of good corporate citizenship, including a commitment to uphold the highest standard of ethical and legal business practices, and the prevention of misconduct. Contractor agrees to conduct all business transactions that occur pursuant to this contract in accordance with all applicable laws, regulations, and Hospital compliance policies, and ensure that Contractors, its officers, employees and agents do the same. Any major compliance violations would be considered a material breach of this contract.

END OF SECTION
BID FORM

TO:       Board of Regents
          University of Washington
          Seattle, Washington 98195

The undersigned Bidder submits the following bid:

BASE BID:

Pursuant to and in compliance with the Contract Documents, including the Request for Bids and Instructions for Bidders, the Bidder hereby certifies that it has, carefully examined the Contract Documents entitled:

UWMC IT EDS Office Space
Prepared by Buffalo Design

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-named project for the following sum, which is hereby designated as the Base Bid:

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<tr>
<th>Base Bid</th>
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Allowances:

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<tr>
<th>Allowance No.:</th>
<th>Description of Allowance:</th>
<th>Allowance Amount:</th>
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<tbody>
<tr>
<td>1</td>
<td>Infection control measures as shown in Drawings a002 and a003 and specified in Section 01 35 33 Infection Control.</td>
<td>$34,000.00</td>
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</table>

Total Base Bid
(Base Bid + all Allowances)

| $        |
SALES TAX:

None of the sums stated in the foregoing include Washington State Sales Tax, except as designated in Article 4 of the Instructions for Bidders.

TIME OF COMPLETION AND LIQUIDATED DAMAGES:

The undersigned Bidder agrees, if awarded the Contract, to complete the Work of the Contract within the number of calendar days specified in Supplemental Conditions, Section 00 73 00, and also agrees to the amounts specified for Liquidated Damages. It is further agreed that the time for completion of the Work described herein is a reasonable time considering the average climatic range and usual industrial conditions prevailing in the locality.

TRENCH EXCAVATION SAFETY PROVISIONS:

If the Contract Documents contain any work which requires trenching exceeding a depth of four feet, all costs for adequate trench safety systems shall be identified as a separate bid item in compliance with Chapter 39.04 RCW and WAC 296-155-650. The purpose of this provision is to ensure that the Bidder agrees to comply with all the relevant trench safety requirements of Chapter 49.17 RCW. This bid amount shall be considered as part of the Base Bid set forth above. Bidder must include a lump sum dollar amount in blank below (even if the value is $0.00) to be responsive.

Trench Excavation Safety Provisions Only: $ N/A

CONTRACT AND BONDS:

If the Owner awards a contract based on this bid within sixty (60) days of the bid submittal deadline, the Bidder agrees to execute a contract for the above work, for compensation computed from the above stated sums, on the University of Washington Public Works Contract form, and to furnish Payment and Performance Bonds and acceptable evidence of insurance as required by the Contract Documents.

BID GUARANTEE:

Pursuant to paragraph 4 of the Instruction to Bidders, Section 00 21 00, Bidder hereby certifies that it has furnished a bid guarantee for no less than 5% of the base bid, and that such guarantee accompanies this Bid Form.

The successful bidder shall submit an executed Contract, Payment and Performance Bonds, and acceptable evidence of insurance within seven (7) days after receipt of award notice and Public Works Contract form from the Owner. If the successful bidder, upon award of a contract by the Owner, fails to execute the Public Works Contract or submit the Payment and Performance Bonds and acceptable evidence of insurance as required within the time specified, Owner may revoke the award. Should the successful bidder fail to enter into a contract with Owner, the bid guarantee may be retained by Owner as liquidated damages, not as a penalty.

If a contract is not awarded within sixty (60) days after the bid submittal deadline, or if the bidder delivers a signed Public Works Contract, Payment and Performance Bonds, and acceptable evidence of insurance, then the certified or cashier’s check or cash submitted as the bid guarantee shall be returned to the bidder, or the Bid Bond shall become void.
Bidder’s Business Name: ____________________________

Type of Business:  
☐ Sole Proprietorship  ☐ Partnership  ☐ Corporation (State of Incorporation: ___)  ☐ Other

Business Address: ____________________________  City: ____________________________  State: ___  Zip Code: ___

Business Telephone Number: ____________________________  Business Fax Number: ____________________________  Business E-mail Address: ____________________________

State of Washington numbers for the following:  
Contractor Registration No.: ____________________________  UBI No.: ____________________________  Employment Security Dept. No.: ____________________________

Receipt is hereby acknowledged of Addenda No(s): ______  ______  ______  ______  ______  ______

Bidder is in compliance with the responsible bidder criteria requirement of RCW 39.04.350(1)(g).

OFFICIAL AUTHORIZED TO SIGN FOR BIDDER:

"I certify (or declare) under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct":

Signature: ____________________________  Date: ____________________________

Print Name and Title: ____________________________  Location or Place Executed: (City, State)
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PART 1 – GENERAL PROVISIONS

1.01 DEFINITIONS

A. “Application for Payment” means a written request submitted by Contractor to A/E for payment of Work completed in accordance with the Contract Documents and approved Schedule of Values, supported by such substantiating data as Owner or A/E may require.

B. “Architect,” “Engineer,” or “A/E” means a person or entity lawfully entitled to practice architecture or engineering, representing Owner within the limits of its delegated authority.

C. “Change Order” means a written instrument signed by Owner and Contractor stating their agreement upon all of the following: (1) a change in the Work; (2) the amount of the adjustment in the Contract Sum, if any, and (3) the extent of the adjustment in the Contract Time, if any.

D. “Claim” means Contractor’s exclusive remedy for resolving disputes with Owner regarding the terms of a Change Order or a request for equitable adjustment, as more fully set forth in Part 8.

E. “Contract Award Amount” is the sum of the Base Bid and any accepted Alternates.

F. “Contract Documents” means the Advertisement for Bids, Instructions for Bidders, completed Bid Form, General Conditions, Modifications to the General Conditions, Supplemental Conditions, Public Works Contract, other Special Forms, Drawings and Specifications, and all addenda and modifications thereof.

G. “Contract Sum” is the total amount payable by Owner to Contractor, for performance of the Work in accordance with the Contract Documents, including all taxes imposed by law and properly chargeable to the Work, except Washington State sales tax.

H. “Contract Time” is the number of calendar days allotted in the Contract Documents for achieving Substantial Completion of the Work.

I. “Contractor” means the person or entity who has agreed with Owner to perform the Work in accordance with the Contract Documents.

J. “Day(s): Unless otherwise specified, day(s) shall mean calendar day(s).”

K. “Drawings” are the graphic and pictorial portions of the Contract Documents showing the design, location, and dimensions of the Work, and may include plans, elevations, sections, details, schedules, and diagrams.

L. “Final Acceptance” means the written acceptance issued to Contractor by Owner after Contractor has completed the requirements of the Contract Documents, as more fully set forth in Section 6.09 B.

M. “Final Completion” means that the Work is fully and finally complete in accordance with the Contract Documents, as more fully set forth in Section 6.09 A.

N. “Force Majeure” means those acts entitling Contractor to request an equitable adjustment in the Contract Time, as more fully set forth in paragraph 3.05A.

O. “Notice” means a written notice which has been delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended or, if delivered or sent by registered or certified mail, to the last business address known to the party giving notice.
P. “Notice to Proceed” means a notice from Owner to Contractor that defines the date on which the Contract Time begins to run.

Q. “Owner” means the state agency, institution, or its authorized representative with the authority to enter into, administer, and/or terminate the Work in accordance with the Contract Documents and make related determinations and findings.

R. “Person” means a corporation, partnership, business association of any kind, trust, company, or individual.

S. “Prior Occupancy” means Owner’s use of all or parts of the Project before Substantial Completion, as more fully set forth in Section 6.08.

T. “Progress Schedule” means a schedule of the Work, in a form satisfactory to Owner, as further set forth in Section 3.02.

U. “Project” means the total construction of which the Work performed in accordance with the Contract Documents may be the whole or a part and which may include construction by Owner or by separate contractors.

V. “Project Record” means the separate set of Drawings and Specifications as further set forth in paragraph 4.02.

W. “Schedule of Values” means a written breakdown allocating the total Contract Sum to each principal category of Work, in such detail as requested by Owner.

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

Y. “Subcontract” means a contract entered into by Subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind for or in connection with the Work.

Z. “Subcontractor” means any person, other than Contractor, who agrees to furnish or furnishes any supplies, materials, equipment, or services of any kind in connection with the Work.

AA. “Substantial Completion” means that stage in the progress of the Work when the construction is sufficiently complete, as more fully set forth in Section 6.07.

AB. “Work” means the construction and services required by the Contract Documents, and includes, but is not limited to, labor, materials, supplies, equipment, services, permits, and the manufacture and fabrication of components, performed, furnished, or provided in accordance with the Contract Documents.

1.02 ORDER OF PRECEDENCE

Any conflict or inconsistency in the Contract Documents shall be resolved by giving the documents precedence in the following order:

1. Signed Public Works Contract, including any Change Orders.

2. Supplemental Conditions.

3. Modifications to the General Conditions.

4. General Conditions.
5. Specifications. Provisions in Division 1 shall take precedence over provisions of any other Division.

6. Drawings. In case of conflict within the Drawings, large scale drawings shall take precedence over small scale drawings.

7. Signed and Completed Bid Form.

8. Instructions to Bidders.

9. Advertisement for Bids.

1.03 EXECUTION AND INTENT

Contractor Representations: Contractor makes the following representations to Owner:

1. Contract Sum reasonable: The Contract Sum is reasonable compensation for the Work and the Contract Time is adequate for the performance of the Work, as represented by the Contract Documents;

2. Contractor familiar with project: Contractor has carefully reviewed the Contract Documents, visited and examined the Project site, become familiar with the local conditions in which the Work is to be performed, and satisfied itself as to the nature, location, character, quality and quantity of the Work, the labor, materials, equipment, goods, supplies, work, services and other items to be furnished and all other requirements of the Contract Documents, as well as the surface and subsurface conditions and other matters that may be encountered at the Project site or affect performance of the Work or the cost or difficulty thereof;

3. Contractor financially capable: Contractor is financially solvent, able to pay its debts as they mature, and possesses sufficient working capital to complete the Work and perform Contractor's obligations required by the Contract Documents; and

4. Contractor can complete Work: Contractor is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform the obligations required by the Contract Documents and has sufficient experience and competence to do so.

PART 2 – INSURANCE AND BONDS

2.01 CONTRACTOR'S LIABILITY INSURANCE

General insurance requirements: Prior to commencement of the Work, Contractor shall obtain all the insurance required by the Contract Documents and provide evidence satisfactory to Owner that such insurance has been procured. Review of the Contractor's insurance by Owner shall not relieve or decrease the liability of Contractor. Companies writing the insurance to be obtained by this part shall be licensed to do business under Chapter 48 RCW or comply with the Surplus Lines Law of the State of Washington. Contractor shall include in its bid the cost of all insurance and bond costs required to complete the base bid work and accepted alternates. Insurance carriers providing insurance in accordance with the Contract Documents shall be acceptable to Owner, and its A.M. Best rating shall be indicated on the insurance certificates.

A. Term of insurance coverage: Contractor shall maintain the following insurance coverage during the Work and for one year after Final Acceptance. Contractor shall also maintain the following insurance coverage during the performance of any corrective Work required by Section 5.16.
1. **General Liability Insurance**: Commercial General Liability (CGL) on an Occurrence Form. Coverage shall include, but not be limited to:
   a. Completed operations/products liability;
   b. Explosion, collapse, and underground; and
   c. Employer’s liability coverage.

2. **Automobile Liability Insurance**: Automobile liability
   
   B. **Industrial Insurance compliance**: Contractor shall comply with the Washington State Industrial Insurance Act and, if applicable, the Federal Longshoremen’s and Harbor Workers’ Act and the Jones Act.
   
   C. **Insurance to protect for the following**: All insurance coverages shall protect against claims for damages for personal and bodily injury or death, as well as claims for property damage, which may arise from operations in connection with the Work whether such operations are by Contractor or any Subcontractor.
   
   D. **Owner as Additional Insured**: All insurance coverages shall be endorsed to include Owner as an additional named insured for Work performed in accordance with the Contract Documents, and all insurance certificates shall evidence the Owner as an additional insured.

2.02 **COVERAGE LIMITS**

Insurance amounts: The coverage limits shall be as follows:

A. Limits of Liability shall not be less than $1,000,000 Combined Single Limit for Bodily Injury and Property Damage (other than Automobile Liability) Each Occurrence; Personal Injury and Advertising Liability Each Occurrence.

B. $2,000,000 Combined Single Limit Annual General Aggregate.

C. $2,000,000 Annual Aggregate for Products and Completed Operations Liability.

D. $1,000,000 Combined Single Limit for Automobile Bodily Injury and Property Damage Liability, Each Accident or Loss.

2.03 **INSURANCE COVERAGE CERTIFICATES**

A. **Certificate required**: Prior to commencement of the Work, Contractor shall furnish to Owner a completed certificate of insurance coverage.

B. **List Project info**: All insurance certificates shall name Owner’s Project number and Project title.

C. **Cancellation provisions**: All insurance certificates shall specifically require 45 Days prior notice to Owner of cancellation or any material change, except 30 Days for surplus line insurance.

2.04 **PAYMENT AND PERFORMANCE BONDS**

Conditions for bonds: Payment and performance bonds for 100% of the Contract Award Amount, plus state sales tax, shall be furnished for the Work, using the Payment Bond and Performance Bond form published by and available from the American Institute of Architects (AIA) – form A312. Prior to execution of a Change Order that, cumulatively with previous Change Orders, increases the Contract Award Amount by 15% or more, the Contractor shall provide either new payment and performance bonds for the
revised Contract Sum, or riders to the existing payment and performance bonds increasing the amount of the bonds. The Contractor shall likewise provide additional bonds or riders when subsequent Change Orders increase the Contract Sum by 15% or more. No payment or performance bond is required if the Contract Sum is $35,000 or less and Contractor agrees that Owner may, in lieu of the bond, retain 50% of the Contract Sum for the period allowed by RCW 39.08.010.

2.05 ALTERNATIVE SURETY

When alternative surety required: Contractor shall promptly furnish payment and performance bonds from an alternative surety as required to protect Owner and persons supplying labor or materials required by the Contract Documents if:

A. Owner has a reasonable objection to the surety; or

B. Any surety fails to furnish reports on its financial condition if required by Owner.

2.06 BUILDER’S RISK

A. Contractor to buy Property Insurance: Contractor shall purchase and maintain property insurance in the amount of the Contract Sum including all Change Orders for the Work on a replacement cost basis until Substantial Completion. For projects not involving New Building Construction, “Installation Floater” is an acceptable substitute for the Builder’s Risk Insurance. The insurance shall cover the interest of Owner, Contractor, and any Subcontractors, as their interests may appear.

B. Losses covered: Contractor property insurance shall be placed on an “all risk” basis and insure against the perils of fire and extended coverage and physical loss or damage including theft, vandalism, malicious mischief, collapse, false work, temporary buildings, debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for A/E’s services and expenses required as a result of an insured loss.

C. Waiver of subrogation rights: Owner and Contractor waive all subrogation rights against each other, any Subcontractors, A/E, A/E’s subconsultants, separate contractors described in Section 5.20, if any, and any of their subcontractors, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this section or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by Owner as fiduciary. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

PART 3 – TIME AND SCHEDULE

3.01 PROGRESS AND COMPLETION

Contractor to meet schedule: Contractor shall diligently prosecute the Work, with adequate forces, achieve Substantial Completion within the Contract Time, and achieve Final Completion within a reasonable period thereafter.

3.02 CONSTRUCTION SCHEDULE

A. Preliminary Progress Schedule: Unless otherwise provided in Division 1, Contractor shall, within 14 Days after issuance of the Notice to Proceed, submit a preliminary Progress Schedule. The Progress Schedule shall show the sequence in which Contractor proposes to perform the Work,
and the dates on which Contractor plans to start and finish major portions of the Work, including dates for shop drawings and other submittals, and for acquiring materials and equipment.

B. **Form of Progress Schedule:** Unless otherwise provided in Division 1, the Progress Schedule shall be in the form of a bar chart, or a critical path method analysis, as specified by Owner. The preliminary Progress Schedule may be general, showing the major portions of the Work, with a more detailed Progress Schedule submitted as directed by Owner.

C. **Owner comments on Progress Schedule:** Owner shall return comments on the preliminary Progress Schedule to Contractor within 14 Days of receipt. Review by Owner of Contractor’s schedule does not constitute an approval or acceptance of Contractor’s construction means, methods, or sequencing, or its ability to complete the Work within the Contract Time. Contractor shall revise and resubmit its schedule, as necessary. Owner may withhold a portion of progress payments until a Progress Schedule has been submitted which meets the requirements of this section.

D. **Monthly updates and compliance with Progress Schedule:** Contractor shall utilize and comply with the Progress Schedule. On a monthly basis, or as otherwise directed by Owner, Contractor shall submit an updated Progress Schedule at its own expense to Owner indicating actual progress. If, in the opinion of Owner, Contractor is not in conformance with the Progress Schedule for reasons other than acts of Force Majeure as identified in Section 3.05, Contractor shall take such steps as are necessary to bring the actual completion dates of its work activities into conformance with the Progress Schedule, and if directed by Owner, Contractor shall submit a corrective action plan or revise the Progress Schedule to reconcile with the actual progress of the Work.

E. **Contractor to notify Owner of delays:** Contractor shall promptly notify Owner in writing of any actual or anticipated event which is delaying or could delay achievement of any milestone or performance of any critical path activity of the Work. Contractor shall indicate the expected duration of the delay, the anticipated effect of the delay on the Progress Schedule, and the action being or to be taken to correct the problem. Provision of such notice does not relieve Contractor of its obligation to complete the Work within the Contract Time.

### 3.03 OWNER’S RIGHT TO SUSPEND THE WORK FOR CONVENIENCE

A. **Owner may suspend Work:** Owner may, at its sole discretion, order Contractor, in writing, to suspend all or any part of the Work for up to 90 Days, or for such longer period as mutually agreed.

B. **Compliance with suspension; Owner’s options:** Upon receipt of a written notice suspending the Work, Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of cost of performance directly attributable to such suspension. Within a period up to 90 Days after the notice is delivered to Contractor, or within any extension of that period to which the parties shall have agreed, Owner shall either:

1. **Cancel the written notice suspending the Work; or**

2. **Terminate the Work covered by the notice as provided in the termination provisions of Part 9.**

C. **Resumption of Work:** If a written notice suspending the Work is cancelled or the period of the notice or any extension thereof expires, Contractor shall resume Work.

D. **Equitable Adjustment for suspensions:** Contractor shall be entitled to an equitable adjustment in the Contract Time, or Contract Sum, or both, for increases in the time or cost of performance.
directly attributable to such suspension, provided Contractor complies with all requirements set forth in Part 7.

3.04 **OWNER’S RIGHT TO STOP THE WORK FOR CAUSE**

A. **Owner may stop Work for Contractor’s failure to perform:** If Contractor fails or refuses to perform its obligations in accordance with the Contract Documents, Owner may order Contractor, in writing, to stop the Work, or any portion thereof, until satisfactory corrective action has been taken.

B. **No Equitable Adjustment for Contractor’s failure to perform:** Contractor shall not be entitled to an equitable adjustment in the Contract Time or Contract Sum for any increased cost or time of performance attributable to Contractor’s failure or refusal to perform or from any reasonable remedial action taken by Owner based upon such failure.

3.05 **DELAY**

A. **Force Majeure actions not a default; Force Majeure defined:** Any delay in or failure of performance by Owner or Contractor, other than the payment of money, shall not constitute a default hereunder if and to the extent the cause for such delay or failure of performance was unforeseeable and beyond the control of the party (“Force Majeure”). Acts of Force Majeure include, but are not limited to:

1. Acts of God or the public enemy;
2. Acts or omissions of any government entity;
3. Fire or other casualty for which Contractor is not responsible;
4. Quarantine or epidemic;
5. Strike or defensive lockout;
6. Unusually severe weather conditions which could not have been reasonably anticipated; and
7. Unusual delay in receipt of supplies or products which were ordered and expedited and for which no substitute reasonably acceptable to Owner was available.

B. **Contract Time adjustment for Force Majeure:** Contractor shall be entitled to an equitable adjustment in the Contract Time for changes in the time of performance directly attributable to an act of Force Majeure, provided it makes a request for equitable adjustment according to Section 7.03. Contractor shall not be entitled to an adjustment in the Contract Sum resulting from an act of Force Majeure.

C. **Contract Time or Contract Sum adjustment if Owner at fault:** Contractor shall be entitled to an equitable adjustment in Contract Time, and may be entitled to an equitable adjustment in Contract Sum, if the cost or time of Contractor’s performance is changed due to the fault or negligence of Owner, provided the Contractor makes a request according to Sections 7.02 and 7.03.

D. **No Contract Time or Contract Sum adjustment if Contractor at fault:** Contractor shall not be entitled to an adjustment in Contract Time or in the Contract Sum for any delay or failure of performance to the extent such delay or failure was caused by Contractor or anyone for whose acts Contractor is responsible.
E. **Contract Time adjustment only for concurrent fault:** To the extent any delay or failure of performance was concurrently caused by the Owner and Contractor, Contractor shall be entitled to an adjustment in the Contract Time for that portion of the delay or failure of performance that was concurrently caused, provided it makes a request for equitable adjustment according to Section 7.03, but shall not be entitled to an adjustment in Contract Sum.

F. **Contractor to mitigate delay impacts:** Contractor shall make all reasonable efforts to prevent and mitigate the effects of any delay, whether occasioned by an act of Force Majeure or otherwise.

3.06 **NOTICE TO OWNER OF LABOR DISPUTES**

A. **Contractor to notify Owner of labor disputes:** If Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay timely performance in accordance with the Contract Documents, Contractor shall immediately give notice, including all relevant information, to Owner.

B. **Pass through notification provisions to Subcontractors:** Contractor agrees to insert a provision in its Subcontracts and to require insertion in all sub-subcontracts, that in the event timely performance of any such contract is delayed or threatened by delay by any actual or potential labor dispute, the Subcontractor or Sub-subcontractor shall immediately notify the next higher tier Subcontractor or Contractor, as the case may be, of all relevant information concerning the dispute.

3.07 **DAMAGES FOR FAILURE TO ACHIEVE TIMELY COMPLETION**

A. **Liquidated Damages**

1. **Reason for Liquidated Damages:** Timely performance and completion of the Work is essential to Owner and time limits stated in the Contract Documents are of the essence. Owner will incur serious and substantial damages if Substantial Completion of the Work does not occur within the Contract Time. However, it would be difficult if not impossible to determine the exact amount of such damages. Consequently, provisions for liquidated damages are included in the Contract Documents.

2. **Calculation of Liquidated Damages amount:** The liquidated damage amounts set forth in the Contract Documents will be assessed not as a penalty, but as liquidated damages for breach of the Contract Documents. This amount is fixed and agreed upon by and between the Contractor and Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain. This amount shall be construed as the actual amount of damages sustained by the Owner, and may be retained by the Owner and deducted from periodic payments to the Contractor.

3. **Contractor responsible even if Liquidated Damages assessed:** Assessment of liquidated damages shall not release Contractor from any further obligations or liabilities pursuant to the Contract Documents.

B. **Actual Damages**

**Calculation of Actual Damages:** Actual damages will be assessed for failure to achieve Final Completion within the time provided. Actual damages will be calculated on the basis of direct architectural, administrative, and other related costs attributable to the Project from the date when Final Completion should have been achieved, based on the date Substantial Completion is actually achieved, to the date Final Completion is actually achieved. Owner may offset these costs against any payment due Contractor.
PART 4 – SPECIFICATIONS, DRAWINGS, AND OTHER DOCUMENTS

4.01 DISCREPANCIES AND CONTRACT DOCUMENT REVIEW

A. Specifications and Drawings are basis of the Work: The intent of the Specifications and Drawings is to describe a complete Project to be constructed in accordance with the Contract Documents. Contractor shall furnish all labor, materials, equipment, tools, transportation, permits, and supplies, and perform the Work required in accordance with the Drawings, Specifications, and other provisions of the Contract Documents.

B. Parts of the Contract Documents are complementary: The Contract Documents are complementary. What is required by one part of the Contract Documents shall be binding as if required by all. Anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both.

C. Contractor to report discrepancies in Contract Documents: Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by Owner. If, during the performance of the Work, Contractor finds a conflict, error, inconsistency, or omission in the Contract Documents, it shall promptly and before proceeding with the Work affected thereby, report such conflict, error, inconsistency, or omission to A/E in writing.

D. Contractor knowledge of discrepancy in documents – responsibility: Contractor shall do no Work without applicable Drawings, Specifications, or written modifications, or Shop Drawings where required, unless instructed to do so in writing by Owner. If Contractor performs any construction activity, and it knows or reasonably should have known that any of the Contract Documents contain a conflict, error, inconsistency, or omission, Contractor shall be responsible for the performance and shall bear the cost for its correction.

E. Contractor to perform Work implied by Contract Documents: Contractor shall provide any work or materials the provision of which is clearly implied and is within the scope of the Contract Documents even if the Contract Documents do not mention them specifically.

F. Interpretation questions referred to A/E: Questions regarding interpretation of the requirements of the Contract Documents shall be referred to the A/E.

4.02 PROJECT RECORD

A. Contractor to maintain Project Record Drawings and Specifications: Contractor shall legibly mark in ink on a separate set of the Drawings and Specifications all actual construction, including depths of foundations, horizontal and vertical locations of internal and underground utilities and appurtenances referenced to permanent visible and accessible surface improvements, field changes of dimensions and details, actual suppliers, manufacturers and trade names, models of installed equipment, and Change Order Proposals (COP). This separate set of Drawings and Specifications shall be the “Project Record.”

B. Update Project Record weekly and keep on site: The Project Record shall be maintained on the project site throughout the construction and shall be clearly labeled “PROJECT RECORD.” The Project Record shall be updated at least weekly noting all changes and shall be available to Owner at all times.

C. Final Project Record to A/E before Final Acceptance: Contractor shall submit the completed and finalized Project Record to A/E prior to Final Acceptance.
4.03 SHOP DRAWINGS

A. Definition of Shop Drawings: “Shop Drawings” means documents and other information required to be submitted to A/E by Contractor pursuant to the Contract Documents, showing in detail: the proposed fabrication and assembly of structural elements; and the installation (i.e. form, fit, and attachment details) of materials and equipment. Shop Drawings include, but are not limited to, drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, samples, and similar materials furnished by Contractor to explain in detail specific portions of the Work required by the Contract Documents. For materials and equipment to be incorporated into the Work, Contractor submittal shall include the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the item. When directed, Contractor shall submit all samples at its own expense. Owner may duplicate, use, and disclose Shop Drawings provided in accordance with the Contract Documents.

B. Approval of Shop Drawings by Contractor and A/E: Contractor shall coordinate all Shop Drawings, and review them for accuracy, completeness, and compliance with the Contract Documents and shall indicate its approval thereon as evidence of such coordination and review. Where required by law, Shop Drawings shall be stamped by an appropriate professional licensed by the state of Washington. Shop Drawings submitted to A/E without evidence of Contractor’s approval shall be returned for resubmission. Contractor shall review, approve, and submit Shop Drawings with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of Owner or separate contractors. Contractor’s submittal schedule shall allow a reasonable time for A/E review. A/E will review, approve, or take other appropriate action on the Shop Drawings. Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings until the respective submittal has been reviewed and the A/E has approved or taken other appropriate action. Owner and A/E shall respond to Shop Drawing submittals with reasonable promptness. Any Work by Contractor shall be in accordance with reviewed Shop Drawings. Submittals made by Contractor which are not required by the Contract Documents may be returned without action.

C. Contractor not relieved of responsibility when Shop Drawings approved: Approval, or other appropriate action with regard to Shop Drawings, by Owner or A/E shall not relieve Contractor of responsibility for any errors or omissions in such Shop Drawings, nor from responsibility for compliance with the requirements of the Contract Documents. Unless specified in the Contract Documents, review by Owner or A/E shall not constitute an approval of the safety precautions employed by Contractor during construction, or constitute an approval of Contractor’s means or methods of construction. If Contractor fails to obtain approval before installation and the item or work is subsequently rejected, Contractor shall be responsible for all costs of correction.

D. Variations between Shop Drawings and Contract Documents: If Shop Drawings show variations from the requirements of the Contract Documents, Contractor shall describe such variations in writing, separate from the Shop Drawings, at the time it submits the Shop Drawings containing such variations. If A/E approves any such variation, an appropriate Change Order will be issued. If the variation is minor and does not involve an adjustment in the Contract Sum or Contract Time, a Change Order need not be issued; however, the modification shall be recorded upon the Project Record.

E. Contractor to submit 5 copies of Shop Drawings: Unless otherwise provided in Division 1, Contractor shall submit to A/E for approval 5 copies of all Shop Drawings. Unless otherwise indicated, 3 sets of all Shop Drawings shall be retained by A/E and 2 sets shall be returned to Contractor.
4.04 **ORGANIZATION OF SPECIFICATIONS**

*Specification organization by trade:* Specifications are prepared in sections which conform generally with trade practices. These sections are for Owner and Contractor convenience and shall not control Contractor in dividing the Work among the Subcontractors or in establishing the extent of the Work to be performed by any trade.

4.05 **OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS, AND OTHER DOCUMENTS**

A. **A/E, not Contractor, owns Copyright of Drawings and Specifications:** The Drawings, Specifications, and other documents prepared by A/E are instruments of A/E’s service through which the Work to be executed by Contractor is described. Neither Contractor nor any Subcontractor shall own or claim a copyright in the Drawings, Specifications, and other documents prepared by A/E, and A/E shall be deemed the author of them and will, along with any rights of Owner, retain all common law, statutory, and other reserved rights, in addition to the copyright. All copies of these documents, except Contractor’s set, shall be returned or suitably accounted for to A/E, on request, upon completion of the Work.

B. **Drawings and Specifications to be used only for this Project:** The Drawings, Specifications, and other documents prepared by the A/E, and copies thereof furnished to Contractor, are for use solely with respect to this Project. They are not to be used by Contractor or any Subcontractor on other projects or for additions to this Project outside the scope of the Work without the specific written consent of Owner and A/E. Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications, and other documents prepared by A/E appropriate to and for use in the execution of their Work.

C. **Shop Drawing license granted to Owner:** Contractor and all Subcontractors grant a non-exclusive license to Owner, without additional cost or royalty, to use for its own purposes (including reproduction) all Shop Drawings, together with the information and diagrams contained therein, prepared by Contractor or any Subcontractor. In providing Shop Drawings, Contractor and all Subcontractors warrant that they have authority to grant to Owner a license to use the Shop Drawings, and that such license is not in violation of any copyright or other intellectual property right. Contractor agrees to defend and indemnify Owner pursuant to the indemnity provisions in Section 5.03 and 5.22 from any violations of copyright or other intellectual property rights arising out of Owner’s use of the Shop Drawings hereunder, or to secure for Owner, at Contractor’s own cost, licenses in conformity with this section.

D. **Shop Drawings to be used only for this Project:** The Shop Drawings and other submittals prepared by Contractor, Subcontractors of any tier, or its or their equipment or material suppliers, and copies thereof furnished to Contractor, are for use solely with respect to this Project. They are not to be used by Contractor or any Subcontractor of any tier, or material or equipment supplier, on other projects or for additions to this Project outside the scope of the Work without the specific written consent of Owner. The Contractor, Subcontractors of any tier, and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Shop Drawings and other submittals appropriate to and for use in the execution of their Work under the Contract Documents.

**PART 5 – PERFORMANCE**

5.01 **CONTRACTOR CONTROL AND SUPERVISION**

A. **Contractor responsible for Means and Methods of construction:** Contractor shall supervise and direct the Work, using its best skill and attention, and shall perform the Work in a skilful manner. Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work, unless the
Contract Documents give other specific instructions concerning these matters. Contractor shall disclose its means and methods of construction when requested by Owner.

B. **Competent Superintendent required:** Performance of the Work shall be directly supervised by a competent superintendent who has authority to act for Contractor. The superintendent must be satisfactory to the Owner and shall not be changed without the prior written consent of Owner. Owner may require Contractor to remove the superintendent from the Work or Project site, if Owner reasonably deems the superintendent incompetent, careless, or otherwise objectionable, provided Owner has first notified Contractor in writing and allowed a reasonable period for transition.

C. **Contractor responsible for acts and omissions of self and agents:** Contractor shall be responsible to Owner for acts and omissions of Contractor, Subcontractors, and their employees and agents.

D. **Contractor to employ competent and disciplined workforce:** Contractor shall enforce strict discipline and good order among all of the Contractor's employees and other persons performing the Work. Contractor shall not permit employment of persons not skilled in tasks assigned to them. Contractor's employees shall at all times conduct business in a manner which assures fair, equal, and nondiscriminatory treatment of all persons. Owner may, by written notice, request Contractor to remove from the Work or Project site any employee Owner reasonably deems incompetent, careless, or otherwise objectionable.

E. **Contractor to keep project documents on site:** Contractor shall keep on the Project site a copy of the Drawings, Specifications, addenda, reviewed Shop Drawings, and permits and permit drawings.

F. **Contractor to comply with ethical standards:** Contractor shall ensure that its owner(s) and employees, and those of its Subcontractors, comply with the Ethics in Public Service Act RCW 42.52, which, among other things, prohibits state employees from having an economic interest in any public works contract that was made by, or supervised by, that employee. Contractor shall remove, at its sole cost and expense, any of its, or its Subcontractors’ employees, if they are in violation of this act.

5.02 PERMITS, FEES, AND NOTICES

A. **Contractor to obtain and pay for permits:** Unless otherwise provided in the Contract Documents, Contractor shall pay for and obtain all permits, licenses, and inspections necessary for proper execution and completion of the Work. Prior to Final Acceptance, the approved, signed permits shall be delivered to Owner.

B. **Allowances for permit fees:** If allowances for permits or utility fees are called for in the Contract Documents and set forth in Contractor's bid, and the actual costs of those permits or fees differ from the allowances in the Contract Documents, the difference shall be adjusted by Change Order.

C. **Contractor to comply with all applicable laws:** Contractor shall comply with and give notices required by all federal, state, and local laws, ordinances, rules, regulations, and lawful orders of public authorities applicable to performance of the Work.

5.03 PATENTS AND ROYALTIES

Payment, indemnification, and notice: Contractor is responsible for, and shall pay, all royalties and license fees. Contractor shall defend, indemnify, and hold Owner harmless from any costs, expenses, and liabilities arising out of the infringement by Contractor of any patent, copyright, or other intellectual property right used in the Work; however, provided that Contractor gives prompt notice, Contractor shall not be responsible for such defense or indemnity when a particular design, process, or product of a
particular manufacturer or manufacturers is required by the Contract Documents. If Contractor has reason to believe that use of the required design, process, or product constitutes an infringement of a patent or copyright, it shall promptly notify Owner of such potential infringement.

5.04 PREVAILING WAGES

A. Contractor to pay Prevailing Wages: Contractor shall pay the prevailing rate of wages to all workers, laborers, or mechanics employed in the performance of any part of the Work in accordance with RCW 39.12 and the rules and regulations of the Department of Labor and Industries. The schedule of prevailing wage rates for the locality or localities of the Work, is determined by the Industrial Statistician of the Department of Labor and Industries. It is the Contractor’s responsibility to verify the applicable prevailing wage rate.

B. Statement of Intent to Pay Prevailing Wages: Before payment is made by the Owner to the Contractor for any work performed by the Contractor and subcontractors whose work is included in the application for payment, the Contractor shall submit, or shall have previously submitted to the Owner for the Project, a Statement of Intent to Pay Prevailing Wages, approved by the Department of Labor and Industries, certifying the rate of hourly wage paid and to be paid each classification of laborers, workers, or mechanics employed upon the Work by Contractor and Subcontractors. Such rates of hourly wage shall not be less than the prevailing wage rate.

C. Affidavit of Wages Paid: Prior to release of retainage, the Contractor shall submit to the Owner an Affidavit of Wages Paid, approved by the Department of Labor and Industries, for the Contractor and every subcontractor, of any tier, that performed work on the Project.

D. Disputes: Disputes regarding prevailing wage rates shall be referred for arbitration to the Director of the Department of Labor and Industries. The arbitration decision shall be final and conclusive and binding on all parties involved in the dispute as provided for by RCW 39.12.060.

E. Statement with pay application; Post Statements of Intent at job site: Each Application for Payment submitted by Contractor shall state that prevailing wages have been paid in accordance with the prefilled statement(s) of intent, as approved. Copies of the approved intent statement(s) shall be posted on the job site with the address and telephone number of the Industrial Statistician of the Department of Labor and Industries where a complaint or inquiry concerning prevailing wages may be made.

F. Contractor to pay for Statements of Intent and Affidavits: In compliance with chapter 296-127 WAC, Contractor shall pay to the Department of Labor and Industries the currently established fee(s) for each statement of intent and/or affidavit of wages paid submitted to the Department of Labor and Industries for certification.

G. Certified Payrolls: Consistent with WAC 296-127-320, the Contractor and any subcontractor shall submit a certified copy of payroll records if requested.

5.05 HOURS OF LABOR

A. Overtime: Contractor shall comply with all applicable provisions of RCW 49.28 and they are incorporated herein by reference. Pursuant to that statute, no laborer, worker, or mechanic employed by Contractor, any Subcontractor, or any other person performing or contracting to do the whole or any part of the Work, shall be permitted or required to work more than eight hours in any one calendar day, provided, that in cases of extraordinary emergency, such as danger to life or property, the hours of work may be extended, but in such cases the rate of pay for time employed in excess of eight hours of each calendar day shall be not less than one and one-half times the rate allowed for this same amount of time during eight hours of service.
B. **4-10 Agreements:** Notwithstanding the preceding paragraph, RCW 49.28 permits a contractor or subcontractor in any public works contract subject to those provisions, to enter into an agreement with its employees in which the employees work up to ten hours in a calendar day. No such agreement may provide that the employees work ten-hour days for more than four calendar days a week. Any such agreement is subject to approval by the employees. The overtime provisions of RCW 49.28 shall not apply to the hours, up to forty hours per week, worked pursuant to any such agreement.

5.06 **NONDISCRIMINATION**

A. **Discrimination prohibited by applicable laws:** Discrimination in all phases of employment is prohibited by, among other laws and regulations, Title VII of the Civil Rights Act of 1964, the Vietnam Era Veterans Readjustment Act of 1974, Sections 503 and 504 of the Vocational Rehabilitation Act of 1973, the Equal Employment Act of 1972, the Age Discrimination Act of 1967, the Americans with Disabilities Act of 1990, the Civil Rights Act of 1991, Presidential Executive Order 11246, Executive Order 11375, the Washington State Law Against Discrimination, RCW 49.60, and Gubernatorial Executive Order 85-09. These laws and regulations establish minimum requirements for affirmative action and fair employment practices which Contractor must meet.

B. **During performance of the Work:**

1. **Protected Classes:** Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability, Vietnam era veteran status, or disabled veteran status, nor commit any other unfair practices as defined in RCW 49.60.

2. **Advertisements to state nondiscrimination:** Contractor shall, in all solicitations or advertisements for employees placed by or for it, state that all qualified applicants will be considered for employment, without regard to race, creed, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability.

3. **Contractor to notify unions and others of nondiscrimination:** Contractor shall send to each labor union, employment agency, or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice advising the labor union, employment agency, or workers’ representative of Contractor’s obligations according to the Contract Documents and RCW 49.60.

4. **Owner and State access to Contractor records:** Contractor shall permit access to its books, records, and accounts, and to its premises by Owner, and by the Washington State Human Rights Commission, for the purpose of investigation to ascertain compliance with this section of the Contract Documents.

5. **Pass through provisions to Subcontractors:** Contractor shall include the provisions of this section in every Subcontract.

5.07 **SAFETY PRECAUTIONS**

A. **Contractor responsible for safety:** Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work.

B. **Contractor safety responsibilities:** In carrying out its responsibilities according to the Contract Documents, Contractor shall protect the lives and health of employees performing the Work and other persons who may be affected by the Work; prevent damage to materials, supplies, and equipment whether on site or stored off-site; and prevent damage to other property at the site or adjacent thereto. Contractor shall comply with all applicable laws, ordinances, rules, regulations,
and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss; shall erect and maintain all necessary safeguards for such safety and protection; and shall notify owners of adjacent property and utilities when prosecution of the Work may affect them.

C. **Contractor to maintain safety records:** Contractor shall maintain an accurate record of exposure data on all incidents relating to the Work resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment. Contractor shall immediately report any such incident to Owner. Owner shall, at all times, have a right of access to all records of exposure.

D. **Contractor to provide HazMat training:** Contractor shall provide all persons working on the Project site with information and training on hazardous chemicals in their work at the time of their initial assignment, and whenever a new hazard is introduced into their work area.

1. **Information.** At a minimum, Contractor shall inform persons working on the Project site of:
   a. **WAC:** The requirements of chapter 296-62 WAC, General Occupational Health Standards;
   b. **Presence of hazardous chemicals:** Any operations in their work area where hazardous chemicals are present; and
   c. **Hazard communications program:** The location and availability of written hazard communication programs, including the required list(s) of hazardous chemicals and material safety data sheets required by chapter 296-62 WAC.

2. **Training.** At a minimum, Contractor shall provide training for persons working on the Project site which includes:
   a. **Detecting hazardous chemicals:** Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);
   b. **Hazards of chemicals:** The physical and health hazards of the chemicals in the work area;
   c. **Protection from hazards:** The measures such persons can take to protect themselves from these hazards, including specific procedures Contractor, or its Subcontractors, or others have implemented to protect those on the Project site from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and
   d. **Hazard communications program:** The details of the hazard communications program developed by Contractor, or its Subcontractors, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

E. **Hazardous, toxic or harmful substances:** Contractor’s responsibility for hazardous, toxic, or harmful substances shall include the following duties:

1. **Illegal use of dangerous substances:** Contractor shall not keep, use, dispose, transport, generate, or sell on or about the Project site, any substances now or hereafter designated as, or which are subject to regulation as, hazardous, toxic, dangerous, or
harmful by any federal, state or local law, regulation, statute or ordinance (hereinafter collectively referred to as “hazardous substances”), in violation of any such law, regulation, statute, or ordinance, but in no case shall any such hazardous substance be stored more than 90 Days on the Project site.

2. Contractor notifications of spills, failures, inspections, and fines: Contractor shall promptly notify Owner of all spills or releases of any hazardous substances which are otherwise required to be reported to any regulatory agency and pay the cost of cleanup. Contractor shall promptly notify Owner of all failures to comply with any federal, state, or local law, regulation, or ordinance; all inspections of the Project site by any regulatory entity concerning the same; all regulatory orders or fines; and all responses or interim cleanup actions taken by or proposed to be taken by any government entity or private party on the Project site.

F. Public safety and traffic: All Work shall be performed with due regard for the safety of the public. Contractor shall perform the Work so as to cause a minimum of interruption of vehicular traffic or inconvenience to pedestrians. All arrangements to care for such traffic shall be Contractor’s responsibilities. All expenses involved in the maintenance of traffic by way of detours shall be borne by Contractor.

G. Contractor to act in an emergency: In an emergency affecting the safety of life or the Work or of adjoining property, Contractor is permitted to act, at its discretion, to prevent such threatened loss or injury, and Contractor shall so act if so authorized or instructed.

H. No duty of safety by Owner or A/E: Nothing provided in this section shall be construed as imposing any duty upon Owner or A/E with regard to, or as constituting any express or implied assumption of control or responsibility over, Project site safety, or over any other safety conditions relating to employees or agents of Contractor or any of its Subcontractors, or the public.

5.08 OPERATIONS, MATERIAL HANDLING, AND STORAGE AREAS

A. Limited storage areas: Contractor shall confine all operations, including storage of materials, to Owner-approved areas.

B. Temporary buildings and utilities at Contractor expense: Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be provided by Contractor only with the consent of Owner and without expense to Owner. The temporary buildings and utilities shall be removed by Contractor at its expense upon completion of the Work.

C. Roads and vehicle loads: Contractor shall use only established roadways or temporary roadways authorized by Owner. When materials are transported in prosecuting the Work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by federal, state, or local law or regulation.

D. Ownership and reporting by Contractor of demolished materials: Ownership and control of all materials or facility components to be demolished or removed from the Project site by Contractor shall immediately vest in Contractor upon severance of the component from the facility or severance of the material from the Project site. Contractor shall be responsible for compliance with all laws governing the storage and ultimate disposal. Contractor shall provide Owner with a copy of all manifests and receipts evidencing proper disposal when required by Owner or applicable law.

E. Contractor responsible for care of materials and equipment on-site: Contractor shall be responsible for the proper care and protection of its materials and equipment delivered to the Project site. Materials and equipment may be stored on the premises subject to approval of
Owner. When Contractor uses any portion of the Project site as a shop, Contractor shall be responsible for any repairs, patching, or cleaning arising from such use.

F. Contractor responsible for loss of materials and equipment: Contractor shall protect and be responsible for any damage or loss to the Work, or to the materials or equipment until the date of Substantial Completion, and shall repair or replace without cost to Owner any damage or loss that may occur, except damages or loss caused by the acts or omissions of Owner. Contractor shall also protect and be responsible for any damage or loss to the Work, or to the materials or equipment, after the date of Substantial Completion, and shall repair or replace without cost to Owner any such damage or loss that might occur, to the extent such damages or loss are caused by the acts or omissions of Contractor, or any Subcontractor.

5.09 PRIOR NOTICE OF EXCAVATION

A. Excavation defined; Use of locator services: “Excavation” means an operation in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means, except the tilling of soil less than 12 inches in depth for agricultural purposes, or road ditch maintenance that does not change the original road grade or ditch flow line. Before commencing any excavation, Contractor shall provide notice of the scheduled commencement of excavation to all owners of underground facilities or utilities, through locator services.

5.10 UNFORESEEN PHYSICAL CONDITIONS

A. Notice requirement for concealed or unknown conditions: If Contractor encounters conditions at the site which are subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents, or unknown physical conditions of an unusual nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then Contractor shall give written notice to Owner promptly and in no event later than 7 Days after the first observance of the conditions. Conditions shall not be disturbed prior to such notice.

B. Adjustment in Contract Time and Contract Sum: If such conditions differ materially and cause a change in Contractor’s cost of, or time required for, performance of any part of the Work, the Contractor may be entitled to an equitable adjustment in the Contract Time or Contract Sum, or both, provided it makes a request therefore as provided in Part 7.

5.11 PROTECTION OF EXISTING STRUCTURES, EQUIPMENT, VEGETATION, UTILITIES AND IMPROVEMENTS

A. Contractor to protect and repair property: Contractor shall protect from damage all existing structures, equipment, improvements, utilities, and vegetation: at or near the Project site; and on adjacent property of a third party, the locations of which are made known to or should be known by Contractor. Contractor shall repair any damage, including that to the property of a third party, resulting from failure to comply with the requirements of the Contract Documents or failure to exercise reasonable care in performing the Work. If Contractor fails or refuses to repair the damage promptly, Owner may have the necessary work performed and charge the cost to Contractor.

B. Tree and vegetation protection: Contractor shall only remove trees when specifically authorized to do so, and shall protect vegetation that will remain in place.

5.12 LAYOUT OF WORK

A. Advanced planning of the Work: Contractor shall plan and lay out the Work in advance of operations so as to coordinate all work without delay or revision.
B. **Layout responsibilities:** Contractor shall lay out the Work from Owner-established baselines and bench marks indicated on the Drawings, and shall be responsible for all field measurements in connection with the layout. Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the Work. Contractor shall be responsible for executing the Work to the lines and grades that may be established. Contractor shall be responsible for maintaining or restoring all stakes and other marks established.

### 5.13 MATERIAL AND EQUIPMENT

A. **Contractor to provide new and equivalent equipment and materials:** All equipment, material, and articles incorporated into the Work shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in the Contract Documents. References in the Specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard quality and shall not be construed as limiting competition. Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of A/E, is equal to that named in the specifications, unless otherwise specifically provided in the Contract Documents.

B. **Contractor responsible for fitting parts together:** Contractor shall do all cutting, fitting, or patching that may be required to make its several parts fit together properly, or receive or be received by work of others set forth in, or reasonably implied by, the Contract Documents. Contractor shall not endanger any work by cutting, excavating, or otherwise altering the Work and shall not cut or alter the work of any other contractor unless approved in advance by Owner.

C. **Owner may reject defective Work:** Should any of the Work be found defective, or in any way not in accordance with the Contract Documents, this work, in whatever stage of completion, may be rejected by Owner.

### 5.14 AVAILABILITY AND USE OF UTILITY SERVICES

A. **Owner to provide and charge for utilities:** Owner shall make all reasonable utilities available to Contractor from existing outlets and supplies, as specified in the Contract Documents. Unless otherwise provided in the Contract Documents, the utility service consumed shall be charged to or paid for by Contractor at prevailing rates charged to Owner or, where the utility is produced by Owner, at reasonable rates determined by Owner. Contractor will carefully conserve any utilities furnished.

B. **Contractor to install temporary connections and meters:** Contractor shall, at its expense and in a skillful manner satisfactory to Owner, install and maintain all necessary temporary connections and distribution lines, together with appropriate protective devices, and all meters required to measure the amount of each utility used for the purpose of determining charges. Prior to the date of Final Acceptance, Contractor shall remove all temporary connections, distribution lines, meters, and associated equipment and materials.

### 5.15 TESTS AND INSPECTION

A. **Contractor to provide for all testing and inspection of Work:** Contractor shall maintain an adequate testing and inspection program and perform such tests and inspections as are necessary or required to ensure that the Work conforms to the requirements of the Contract Documents. Contractor shall be responsible for inspection and quality surveillance of all its Work and all Work performed by any Subcontractor. Unless otherwise provided, Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. Contractor shall give Owner timely notice of when and...
where tests and inspections are to be made. Contractor shall maintain complete inspection records and make them available to Owner.

B. **Owner may conduct tests and inspections:** Owner may, at any reasonable time, conduct such inspections and tests as it deems necessary to ensure that the Work is in accordance with the Contract Documents. Owner shall promptly notify Contractor if an inspection or test reveals that the Work is not in accordance with the Contract Documents. Unless the subject items are expressly accepted by Owner, such Owner inspection and tests are for the sole benefit of Owner and do not:

1. Constitute or imply acceptance;
2. Relieve Contractor of responsibility for providing adequate quality control measures;
3. Relieve Contractor of responsibility for risk of loss or damage to the Work, materials, or equipment;
4. Relieve Contractor of its responsibility to comply with the requirements of the Contract Documents; or
5. Impair Owner’s right to reject defective or nonconforming items, or to avail itself of any other remedy to which it may be entitled.

C. **Inspections or inspectors do not modify Contract Documents:** Neither observations by an inspector retained by Owner, the presence or absence of such inspector on the site, nor inspections, tests, or approvals by others, shall relieve Contractor from any requirement of the Contract Documents, nor is any such inspector authorized to change any term or condition of the Contract Documents.

D. **Contractor responsibilities on inspections:** Contractor shall promptly furnish, without additional charge, all facilities, labor, material and equipment reasonably needed for performing such safe and convenient inspections and tests as may be required by Owner. Owner may charge Contractor any additional cost of inspection or testing when Work is not ready at the time specified by Contractor for inspection or testing, or when prior rejection makes reinspection or retest necessary. Owner shall perform its inspections and tests in a manner that will cause no undue delay in the Work.

5.16 **CORRECTION OF NONCONFORMING WORK**

A. **Work covered by Contractor without inspection:** If a portion of the Work is covered contrary to the requirements in the Contract Documents, it must, if required in writing by Owner, be uncovered for Owner's observation and be replaced at the Contractor's expense and without change in the Contract Time.

B. **Payment provisions for uncovering covered Work:** If, at any time prior to Final Completion, Owner desires to examine the Work, or any portion of it, which has been covered, Owner may request to see such Work and it shall be uncovered by Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an adjustment in the Contract Sum for the costs of uncovering and replacement, and, if completion of the Work is thereby delayed, an adjustment in the Contract Time, provided it makes such a request as provided in Part 7. If such Work is not in accordance with the Contract Documents, the Contractor shall pay the costs of examination and reconstruction.

C. **Contractor to correct and pay for non-conforming Work:** Contractor shall promptly correct Work found by Owner not to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed, or
completed. Contractor shall bear all costs of correcting such nonconforming Work, including additional testing and inspections.

D. Contractor’s compliance with warranty provisions: If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or within one year after the date for commencement of any system warranties established under Section 6.08, or within the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, Contractor shall correct it promptly after receipt of written notice from Owner to do so. Owner shall give such notice promptly after discovery of the condition. This period of one year shall be extended, with respect to portions of Work first performed after Substantial Completion, by the period of time between Substantial Completion and the actual performance of the Work. Contractor’s duty to correct with respect to Work repaired or replaced shall run for one year from the date of repair or replacement. Obligations under this paragraph shall survive Final Acceptance.

E. Contractor to remove non-conforming Work: Contractor shall remove from the Project site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by Contractor nor accepted by Owner.

F. Owner may charge Contractor for non-conforming Work: If Contractor fails to correct nonconforming Work within a reasonable time after written notice to do so, Owner may replace, correct, or remove the nonconforming Work and charge the cost thereof to the Contractor.

G. Contractor to pay for damaged Work during correction: Contractor shall bear the cost of correcting destroyed or damaged Work, whether completed or partially completed, caused by Contractor’s correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

H. No Period of limitation on other requirements: Nothing contained in this section shall be construed to establish a period of limitation with respect to other obligations which Contractor might have according to the Contract Documents. Establishment of the time period of one year as described in Section 5.16D relates only to the specific obligation of Contractor to correct the Work, and has no relationship to the time within which the Contractor’s obligation to comply with the Contract Documents may be sought to be enforced, including the time within which such proceedings may be commenced.

I. Owner may accept non-conforming Work and charge Contractor: If Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, Owner may do so instead of requiring its removal and correction, in which case the Contract Sum may be reduced as appropriate and equitable.

5.17 CLEAN UP

Contractor to keep site clean and leave it clean: Contractor shall at all times keep the Project site, including hauling routes, infrastructures, utilities, and storage areas, free from accumulations of waste materials. Before completing the Work, Contractor shall remove from the premises its rubbish, tools, scaffolding, equipment, and materials. Upon completing the Work, Contractor shall leave the Project site in a clean, neat, and orderly condition satisfactory to Owner. If Contractor fails to clean up as provided herein, and after reasonable notice from Owner, Owner may do so and the cost thereof shall be charged to Contractor.

5.18 ACCESS TO WORK

Owner and A/E access to Work site: Contractor shall provide Owner and A/E access to the Work in progress wherever located.
5.19 OTHER CONTRACTS

Owner may award other contracts; Contractor to cooperate: Owner may undertake or award other contracts for additional work at or near the Project site. Contractor shall reasonably cooperate with the other contractors and with Owner’s employees and shall carefully adapt scheduling and perform the Work in accordance with these Contract Documents to reasonably accommodate the other work.

5.20 SUBCONTRACTORS AND SUPPLIERS

A. Subcontractor Responsibility: The Contractor shall include the language of this paragraph in each of its first tier subcontracts, and shall require each of its subcontractors to include the same language of this section in each of their subcontracts, adjusting only as necessary the terms used for the contracting parties. Upon request of the Owner, the Contractor shall promptly provide documentation to the Owner demonstrating that the subcontractor meets the subcontractor responsibility criteria below. The requirements of this paragraph apply to all subcontractors regardless of tier. At the time of subcontract execution, the Contractor shall verify that each of its first tier subcontractors meets the following bidder responsibility criteria:

1. Have a current certificate of registration as a contractor in compliance with chapter 18.27 RCW, which must have been in effect at the time of subcontract bid submittal;

2. Have a current Washington Unified Business Identifier (UBI) number;

3. If applicable, have:
   a. Industrial Insurance (workers’ compensation) coverage for the subcontractor’s employees working in Washington, as required in Title 51 RCW;
   b. A Washington Employment Security Department number, as required in Title 50 RCW;
   c. A Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
   d. An electrical contractor license, if required by Chapter 19.28 RCW;
   e. An elevator contractor license, if required by Chapter 70.87 RCW.

4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065 (3).

5. On a project subject to the apprenticeship utilization requirements in RCW 39.04.320, not have been found out of compliance by the Washington state apprenticeship and training council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under chapter 49.04 RCW for the one-year period immediately preceding the date of the Owner’s first advertisement of the project.

B. Provide names of Subcontractors and use qualified firms: Before submitting the first Application for Payment, Contractor shall furnish in writing to Owner the names, addresses, and telephone numbers of all Subcontractors, as well as suppliers providing materials in excess of $2,500. Contractor shall utilize Subcontractors and suppliers which are experienced and qualified, and meet the requirements of the Contract Documents, if any. Contractor shall not utilize any Subcontractor or supplier to whom the Owner has a reasonable objection, and shall obtain Owner’s written consent before making any substitutions or additions.
C. **Subcontracts in writing and pass through provision:** All Subcontracts must be in writing. By appropriate written agreement, Contractor shall require each Subcontractor, so far as applicable to the Work to be performed by the Subcontractor, to be bound to Contractor by terms of the Contract Documents, and to assume toward Contractor all the obligations and responsibilities which Contractor assumes toward Owner in accordance with the Contract Documents. Each Subcontract shall preserve and protect the rights of Owner in accordance with the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights. Where appropriate, Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. However, nothing in this paragraph shall be construed to alter the contractual relations between Contractor and its Subcontractors with respect to insurance or bonds.

D. **Coordination of Subcontractors; Contractor responsible for Work:** Contractor shall schedule, supervise, and coordinate the operations of all Subcontractors. No Subcontracting of any of the Work shall relieve Contractor from its responsibility for the performance of the Work in accordance with the Contract Documents or any other obligations of the Contract Documents.

E. **Automatic assignment of subcontracts:** Each subcontract agreement for a portion of the Work is hereby assigned by Contractor to Owner provided that:

1. **Effective only after termination and Owner approval:** The assignment is effective only after termination by Owner for cause pursuant to Section 9.01 and only for those Subcontracts which Owner accepts by notifying the Subcontractor in writing; and

2. **Owner assumes Contractor’s responsibilities:** After the assignment is effective, Owner will assume all future duties and obligations toward the Subcontractor which Contractor assumed in the Subcontract.

3. **Impact of bond:** The assignment is subject to the prior rights of the surety, if any, obligated under any bond provided in accordance with the Contract Documents.

5.21 **WARRANTY OF CONSTRUCTION**

A. **Contractor warranty of Work:** In addition to any special warranties provided elsewhere in the Contract Documents, Contractor warrants that all Work conforms to the requirements of the Contract Documents and is free of any defect in equipment, material, or design furnished, or workmanship performed by Contractor.

B. **Contractor responsibilities:** With respect to all warranties, express or implied, for Work performed or materials furnished according to the Contract Documents, Contractor shall:

1. **Obtain warranties:** Obtain all warranties that would be given in normal commercial practice;

2. **Warranties for benefit of Owner:** Require all warranties to be executed, in writing, for the benefit of Owner;

3. **Enforcement of warranties:** Enforce all warranties for the benefit of Owner, if directed by Owner; and

4. **Contractor responsibility for subcontractor warranties:** Be responsible to enforce any subcontractor’s, manufacturer’s, or supplier’s warranties should they extend beyond the period specified in the Contract Documents.

C. **Warranties beyond Final Acceptance:** The obligations under this section shall survive Final Acceptance.
5.22 INDEMNIFICATION

A. Contractor to indemnify Owner: Contractor shall defend, indemnify, and hold Owner and A/E harmless from and against all claims, demands, losses, damages, or costs, including but not limited to damages arising out of bodily injury or death to persons and damage to property, caused by or resulting from:

1. Sole negligence of Contractor: The sole negligence of Contractor or any of its Subcontractors;

2. Concurrent negligence: The concurrent negligence of Contractor, or any Subcontractor, but only to the extent of the negligence of Contractor or such Subcontractor; and

3. Patent infringement: The use of any design, process, or equipment which constitutes an infringement of any United States patent presently issued, or violates any other proprietary interest, including copyright, trademark, and trade secret.

B. Employee action and RCW Title 51: In any action against Owner and any other entity indemnified in accordance with this section, by any employee of Contractor, its Subcontractors, Sub-subcontractors, agents, or anyone directly or indirectly employed by any of them, the indemnification obligation of this section shall not be limited by a limit on the amount or type of damages, compensation, or benefits payable by or for Contractor or any Subcontractor under RCW Title 51, the Industrial Insurance Act, or any other employee benefit acts. In addition, Contractor waives immunity as to Owner and A/E only, in accordance with RCW Title 51.

PART 6 – PAYMENTS AND COMPLETION

6.01 CONTRACT SUM

Owner shall pay Contract Sum: Owner shall pay Contractor the Contract Sum plus state sales tax for performance of the Work, in accordance with the Contract Documents.

6.02 SCHEDULE OF VALUES

Contractor to submit Schedule of Values: Before submitting its first Application for Payment, Contractor shall submit to Owner for approval a breakdown allocating the total Contract Sum to each principal category of work, in such detail as requested by Owner (“Schedule of Values”). The approved Schedule of Values shall include appropriate amounts for demobilization, record drawings, O&M manuals, and any other requirements for Project closeout, and shall be used by Owner as the basis for progress payments. Payment for Work shall be made only for and in accordance with those items included in the Schedule of Values.

6.03 APPLICATION FOR PAYMENT

A. Monthly Application for Payment with substantiation: At monthly intervals, unless determined otherwise by Owner, Contractor shall submit to Owner an itemized Application for Payment for Work completed in accordance with the Contract Documents and the approved Schedule of Values. Each application shall be supported by such substantiating data as Owner may require.

B. Contractor certifies Subcontractors paid: By submitting an Application for Payment, Contractor is certifying that all Subcontractors have been paid, less earned retainage in accordance with RCW 60.28.011, as their interests appeared in the last preceding certificate of payment. By submitting an Application for Payment, Contractor is recertifying that the representations set forth in Section 1.03, are true and correct, to the best of Contractor’s knowledge, as of the date of the Application for Payment.
C. Reconciliation of Work with Progress Schedule: At the time it submits an Application for Payment, Contractor shall analyze and reconcile, to the satisfaction of Owner, the actual progress of the Work with the Progress Schedule.

D. Payment for material delivered to site or stored off-site: If authorized by Owner, the Application for Payment may include request for payment for material delivered to the Project site and suitably stored, or for completed preparatory work. Payment may similarly be requested for material stored off the Project site, provided Contractor complies with or furnishes satisfactory evidence of the following:

1. Suitable facility or location: The material will be placed in a facility or location that is structurally sound, dry, lighted and suitable for the materials to be stored;

2. Facility or location within 10 miles of Project: The facility or location is located within a 10-mile radius of the Project. Other locations may be utilized, if approved in writing, by Owner;

3. Facility or location exclusive to Project's materials: Only materials for the Project are stored within the facility or location (or a secure portion of a facility or location set aside for the Project);

4. Insurance provided on materials in facility or location: Contractor furnishes Owner a certificate of insurance extending Contractor’s insurance coverage for damage, fire, and theft to cover the full value of all materials stored, or in transit;

5. Facility or location locked and secure: The facility or location (or secure portion thereof) is continuously under lock and key, and only Contractor’s authorized personnel shall have access;

6. Owner right of access to facility or location: Owner shall at all times have the right of access in company of Contractor;

7. Contractor assumes total responsibility for stored materials: Contractor and its surety assume total responsibility for the stored materials; and

8. Contractor provides documentation and Notice when materials moved to site: Contractor furnishes to Owner certified lists of materials stored, bills of lading, invoices, and other information as may be required, and shall also furnish Notice to Owner when materials are moved from storage to the Project site.

6.04 PROGRESS PAYMENTS

A. Owner to pay within 30 Days: Owner shall make progress payments, in such amounts as Owner determines are properly due, within 30 Days after receipt of a properly executed Application for Payment. Owner shall notify Contractor in accordance with chapter 39.76 RCW if the Application for Payment does not comply with the requirements of the Contract Documents.

B. Withholding retainage; Options for retainage: Owner shall retain 5% of the amount of each progress payment until 45 Days after Final Acceptance and receipt of all documents required by law or the Contract Documents, including, at Owner’s request, consent of surety to release of the retainage. In accordance with chapter 60.28 RCW, Contractor may request that monies reserved be retained in a fund by Owner, deposited by Owner in a bank or savings and loan, or placed in escrow with a bank or trust company to be converted into bonds and securities to be held in escrow with interest to be paid to Contractor. Owner may permit Contractor to provide an appropriate bond in lieu of the retained funds.
C. **Title passes to Owner upon payment:** Title to all Work and materials covered by a progress payment shall pass to Owner at the time of such payment free and clear of all liens, claims, security interests, and encumbrances. Passage of title shall not, however, relieve Contractor from any of its duties and responsibilities for the Work or materials, or waive any rights of Owner to insist on full compliance by Contractor with the Contract Documents.

D. **Interest on unpaid balances:** Payments due and unpaid in accordance with the Contract Documents shall bear interest as specified in chapter 39.76 RCW.

### 6.05 PAYMENTS WITHHELD

**A. Owner’s right to withhold payment:** Owner may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any payment to such extent as may be necessary to protect Owner from loss or damage for reasons including but not limited to:

1. **Non-compliant Work:** Work not in accordance with the Contract Documents;

2. **Remaining Work to cost more than unpaid balance:** Reasonable evidence that the Work required by the Contract Documents cannot be completed for the unpaid balance of the Contract Sum;

3. **Owner correction or completion Work:** Work by Owner to correct defective Work or complete the Work in accordance with Section 5.16;

4. **Contractor’s failure to perform:** Contractor’s failure to perform in accordance with the Contract Documents; or

5. **Contractor’s negligent acts or omissions:** Cost or liability that may occur to Owner as the result of Contractor’s fault or negligent acts or omissions.

**B. Owner to notify Contractor of withholding for unsatisfactory performance:** In any case where part or all of a payment is going to be withheld for unsatisfactory performance, Owner shall notify Contractor in accordance with chapter 39.76 RCW.

### 6.06 RETAINAGE AND BOND CLAIM RIGHTS

**Chapters 39.08 RCW and 60.28 RCW incorporated by reference:** Chapters 39.08 RCW and 60.28 RCW, concerning the rights and responsibilities of Contractor and Owner with regard to the performance and payment bonds and retainage, are made a part of the Contract Documents by reference as though fully set forth herein.

### 6.07 SUBSTANTIAL COMPLETION

**Substantial Completion defined:** Substantial Completion is the stage in the progress of the Work (or portion thereof designated and approved by Owner) when the construction is sufficiently complete, in accordance with the Contract Documents, so Owner has full and unrestricted use and benefit of the facilities (or portion thereof designated and approved by Owner) for the use for which it is intended. All Work other than incidental corrective or punch list work shall be completed. Substantial Completion shall not have been achieved if all systems and parts are not functional, if utilities are not connected and operating normally, if all required occupancy permits have not been issued, or if the Work is not accessible by normal vehicular and pedestrian traffic routes. The date Substantial Completion is achieved shall be established in writing by Owner. Contractor may request an early date of Substantial Completion which must be approved by Change Order. Owner’s occupancy of the Work or designated portion thereof does not necessarily indicate that Substantial Completion has been achieved.

*July 1, 2010*
6.08 PRIOR OCCUPANCY

A. Prior Occupancy defined; Restrictions: Owner may, upon written notice thereof to Contractor, take possession of or use any completed or partially completed portion of the Work (“Prior Occupancy”) at any time prior to Substantial Completion. Unless otherwise agreed in writing, Prior Occupancy shall not: be deemed an acceptance of any portion of the Work; accelerate the time for any payment to Contractor; prejudice any rights of Owner provided by any insurance, bond, guaranty, or the Contract Documents; relieve Contractor of the risk of loss or any of the obligations established by the Contract Documents; establish a date for termination or partial termination of the assessment of liquidated damages; or constitute a waiver of claims.

B. Damage; Duty to repair and warranties: Notwithstanding anything in the preceding paragraph, Owner shall be responsible for loss of or damage to the Work resulting from Prior Occupancy. Contractor’s one year duty to repair any system warranties shall begin on building systems activated and used by Owner as agreed in writing by Owner and Contractor.

6.09 FINAL COMPLETION, ACCEPTANCE, AND PAYMENT

A. Final Completion defined: Final Completion shall be achieved when the Work is fully and finally complete in accordance with the Contract Documents. The date Final Completion is achieved shall be established by Owner in writing, but in no case shall constitute Final Acceptance which is a subsequent, separate, and distinct action.

B. Final Acceptance defined: Final Acceptance shall be achieved when the Contractor has completed the requirements of the Contract Documents. The date Final Acceptance is achieved shall be established by Owner in writing. Prior to Final Acceptance, Contractor shall, in addition to all other requirements in the Contract Documents, submit to Owner a written notice of any outstanding disputes or claims between Contractor and any of its Subcontractors, including the amounts and other details thereof. Neither Final Acceptance, nor final payment, shall release Contractor or its sureties from any obligations of these Contract Documents or the payment and performance bonds, or constitute a waiver of any claims by Owner arising from Contractor’s failure to perform the Work in accordance with the Contract Documents.

C. Final payment waives Claim rights: Acceptance of final payment by Contractor, or any Subcontractor, shall constitute a waiver and release to Owner of all claims by Contractor, or any such Subcontractor, for an increase in the Contract Sum or the Contract Time, and for every act or omission of Owner relating to or arising out of the Work, except for those Claims made in accordance with the procedures, including the time limits, set forth in Part 8.

PART 7 – CHANGES

7.01 CHANGE IN THE WORK

A. Changes in Work, Contract Sum, and Contract Time by Change Order: Owner may, at any time and without notice to Contractor’s surety, order additions, deletions, revisions, or other changes in the Work. These changes in the Work shall be incorporated into the Contract Documents through the execution of Change Orders. If any change in the Work ordered by Owner causes an increase or decrease in the Contract Sum or the Contract Time, an equitable adjustment shall be made as provided in Section 7.02 or 7.03, respectively, and such adjustment(s) shall be incorporated into a Change Order.

B. Owner may request COP from Contractor: If Owner desires to order a change in the Work, it may request a written Change Order Proposal (COP) from Contractor. Contractor shall submit a Change Order Proposal within 14 Days of the request from Owner, or within such other period as mutually agreed. Contractor’s Change Order Proposal shall be full compensation for
implementing the proposed change in the Work, including any adjustment in the Contract Sum or Contract Time, and including compensation for all delays in connection with such change in the Work and for any expense or inconvenience, disruption of schedule, or loss of efficiency or productivity occasioned by the change in the Work.

C. **COP negotiations:** Upon receipt of the Change Order Proposal, or a request for equitable adjustment in the Contract Sum or Contract Time, or both, as provided in Sections 7.02 and 7.03, Owner may accept or reject the proposal, request further documentation, or negotiate acceptable terms with Contractor. Pending agreement on the terms of the Change Order, Owner may direct Contractor to proceed immediately with the Change Order Work. Contractor shall not proceed with any change in the Work until it has obtained Owner’s approval. All Work done pursuant to any Owner-directed change in the Work shall be executed in accordance with the Contract Documents.

D. **Change Order as full payment and final settlement:** If Owner and Contractor reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, such agreement shall be incorporated in a Change Order. The Change Order shall constitute full payment and final settlement of all claims for time and for direct, indirect, and consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity, related to any Work either covered or affected by the Change Order, or related to the events giving rise to the request for equitable adjustment.

E. **Failure to agree upon terms of Change Order; Final offer and Claims:** If Owner and Contractor are unable to reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, Contractor may at any time in writing, request a final offer from Owner. Owner shall provide Contractor with its written response within 30 Days of Contractor’s request. Owner may also provide Contractor with a final offer at any time. If Contractor rejects Owner’s final offer, or the parties are otherwise unable to reach agreement, Contractor’s only remedy shall be to file a Claim as provided in Part 8.

F. **Field Authorizations:** The Owner may direct the Contractor to proceed with a change in the work through a written Field Authorization (also referred to as a Field Order) when the time required to price and execute a Change Order would impact the Project.

The Field Authorization shall describe and include the following:

1. The scope of work
2. An agreed upon maximum not-to-exceed amount
3. Any estimated change to the Contract Time
4. The method of final cost determination in accordance with the requirements of Part 7 of the General Conditions
5. The supporting cost data to be submitted in accordance with the requirements of Part 7 of the General Conditions

Upon satisfactory submittal by the Contractor and approval by the Owner of supporting cost data, a Change Order will be executed. The Owner will not make payment to the Contractor for Field Authorization work until that work has been incorporated into an executed Change Order.
7.02 CHANGE IN THE CONTRACT SUM

A. General Application

1. Contract Sum changes only by Change Order: The Contract Sum shall only be changed by a Change Order. Contractor shall include any request for a change in the Contract Sum in its Change Order Proposal.

2. Owner fault or negligence as basis for change in Contract Sum: If the cost of Contractor's performance is changed due to the fault or negligence of Owner, or anyone for whose acts Owner is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Sum in accordance with the following procedure. No change in the Contract Sum shall be allowed to the extent: Contractor's changed cost of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible; the change is concurrently caused by Contractor and Owner; or the change is caused by an act of Force Majeure as defined in Section 3.05.

   (a) Notice and record keeping for equitable adjustment: A request for an equitable adjustment in the Contract Sum shall be based on written notice delivered to Owner within 7 Days of the occurrence of the event giving rise to the request. For purposes of this part, “occurrence” means when Contractor knew, or in its diligent prosecution of the Work should have known, of the event giving rise to the request. If Contractor believes it is entitled to an adjustment in the Contract Sum, Contractor shall immediately notify Owner and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Owner access to any such records and, if requested shall promptly furnish copies of such records to Owner.

   (b) Content of notice for equitable adjustment; Failure to comply: Contractor shall not be entitled to any adjustment in the Contract Sum for any occurrence of events or costs that occurred more than 7 Days before Contractor's written notice to Owner. The written notice shall set forth, at a minimum, a description of: the event giving rise to the request for an equitable adjustment in the Contract Sum; the nature of the impacts to Contractor and its Subcontractors of any tier, if any; and to the extent possible the amount of the adjustment in Contract Sum requested. Failure to properly give such written notice shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

   (c) Contractor to provide supplemental information: Within 30 Days of the occurrence of the event giving rise to the request, unless Owner agrees in writing to allow an additional period of time to ascertain more accurate data, Contractor shall supplement the written notice provided in accordance with subparagraph a. above with additional supporting data. Such additional data shall include, at a minimum: the amount of compensation requested, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the damages claimed, but that the damages claimed were actually a result of the act, event, or condition complained of and that the Contract Documents provide entitlement to an equitable adjustment to Contractor for such act, event, or condition; and documentation sufficiently detailed to permit an informed analysis of the request by Owner. When the request for compensation relates to a delay, or other change in Contract Time, Contractor shall demonstrate the impact on the critical path, in accordance with Section 7.03C. Failure to provide such additional information and documentation within the time allowed or within the format required shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.
(d) Contractor to proceed with Work as directed: Pending final resolution of any request made in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

(e) Contractor to combine requests for same event together: Any requests by Contractor for an equitable adjustment in the Contract Sum and in the Contract Time that arise out of the same event(s) shall be submitted together.

3. Methods for calculating Change Order amount: The value of any Work covered by a Change Order, or of any request for an equitable adjustment in the Contract Sum, shall be determined by one of the following methods:

   a. Fixed Price: On the basis of a fixed price as determined in paragraph 7.02B.

   b. Unit Prices: By application of unit prices to the quantities of the items involved as determined in paragraph 7.02C.

   c. Time and Materials: On the basis of time and material as determined in paragraph 7.02D.

4. Fixed price method is default; Owner may direct otherwise: When Owner has requested Contractor to submit a Change Order Proposal, Owner may direct Contractor as to which method in subparagraph 3 above to use when submitting its proposal. Otherwise, Contractor shall determine the value of the Work, or of a request for an equitable adjustment, on the basis of the fixed price method.

B. Change Order Pricing – Fixed Price

Procedures: When the fixed price method is used to determine the value of any Work covered by a Change Order, or of a request for an equitable adjustment in the Contract Sum, the following procedures shall apply:

1. Breakdown and itemization of details on COP: Contractor’s Change Order Proposal, or request for adjustment in the Contract Sum, shall be accompanied by a complete itemization of the costs, including labor, material, subcontractor costs, and overhead and profit. The costs shall be itemized in the manner set forth below, and shall be submitted on breakdown sheets in a form approved by Owner.

2. Use of industry standards in calculating costs: All costs shall be calculated based upon appropriate industry standard methods of calculating labor, material quantities, and equipment costs.

3. Costs contingent on Owner’s actions: If any of Contractor’s pricing assumptions are contingent upon anticipated actions of Owner, Contractor shall clearly state them in the proposal or request for an equitable adjustment.

4. Markups on additive and deductive Work: The cost of any additive or deductive changes in the Work shall be calculated as set forth below, except that overhead and profit shall not be included on deductive changes in the Work. Where a change in the Work involves additive and deductive work by the same Contractor or Subcontractor, small tools, overhead, profit, bond and insurance markups will apply to the net difference.

5. Breakdown not required if change less than $1,000: If the total cost of the change in the Work or request for equitable adjustment does not exceed $1,000, Contractor shall not be required to submit a breakdown if the description of the change in the Work or request for equitable adjustment is sufficiently definitive for Owner to determine fair value.
6. **Breakdown required if change between $1,000 and $2,500:** If the total cost of the change in the Work or request for equitable adjustment is between $1,000 and $2,500, Contractor may submit a breakdown in the following level of detail if the description of the change in the Work or if the request for equitable adjustment is sufficiently definitive to permit the Owner to determine fair value:

a. lump sum labor;
b. lump sum material;
c. lump sum equipment usage;
d. overhead and profit as set forth below; and
e. insurance and bond costs as set forth below.

7. **Components of increased cost:** Any request for adjustment of Contract Sum based upon the fixed price method shall include only the following items:

a. **Craft labor costs:** These are the labor costs determined by multiplying the estimated or actual additional number of craft hours needed to perform the change in the Work by the hourly labor costs. Craft hours should cover direct labor, as well as indirect labor due to trade inefficiencies. The hourly costs shall be based on the following:

   (1) **Basic wages and benefits:** Hourly rates and benefits as stated on the Department of Labor and Industries approved “statement of intent to pay prevailing wages” or a higher amount if approved by the Owner. Direct supervision shall be a reasonable percentage not to exceed 15% of the cost of direct labor. No supervision markup shall be allowed for a working supervisor’s hours.

   (2) **Worker’s insurance:** Direct contributions to the state of Washington for industrial insurance; medical aid; and supplemental pension, by the class and rates established by the Department of Labor and Industries.

   (3) **Federal insurance:** Direct contributions required by the Federal Insurance Compensation Act; Federal Unemployment Tax Act; and the State Unemployment Compensation Act.

   (4) **Travel allowance:** Travel allowance and/or subsistence, if applicable, not exceeding those allowances established by regional labor union agreements, which are itemized and identified separately.

   (5) **Safety:** Cost incurred due to the Washington Industrial Safety and Health Act, which shall be a reasonable percentage not to exceed 2% of the sum of the amounts calculated in (1), (2), and (3) above.

b. **Material costs:** This is an itemization of the quantity and cost of materials needed to perform the change in the Work. Material costs shall be developed first from actual known costs, second from supplier quotations or if these are not available, from standard industry pricing guides. Material costs shall consider all available discounts. Freight costs, express charges, or special delivery charges, shall be itemized.
c. **Equipment costs:** This is an itemization of the type of equipment and the estimated or actual length of time the construction equipment appropriate for the Work is or will be used on the change in the Work. Costs will be allowed for construction equipment only if used solely for the changed Work, or for additional rental costs actually incurred by the Contractor. Equipment charges shall be computed on the basis of actual invoice costs or if owned, from the current edition of one of the following sources:

2. The National Electrical Contractors Association for equipment used on electrical work.
3. The Mechanical Contractors Association of America for equipment used on mechanical work.

The EquipmentWatch Rental Rate Blue Book shall be used as a basis for establishing rental rates of equipment not listed in the above sources. The maximum rate for standby equipment shall not exceed that shown in the AGC WSDOT Equipment Rental Agreement, current edition on the Contract execution date.

d. **Allowance for small tools, expendables & consumable supplies:** Small tools consist of tools which cost $250 or less and are normally furnished by the performing contractor. The maximum rate for small tools shall not exceed the following:

1. **3% for Contractor:** For Contractor, 3% of direct labor costs.
2. **5% for Subcontractors:** For Subcontractors, 5% of direct labor costs.

Expendables and consumables supplies directly associated with the change in Work must be itemized.

e. **Subcontractor costs:** This is defined as payments Contractor makes to Subcontractors for changed Work performed by Subcontractors of any tier. The Subcontractors’ cost of Work shall be calculated and itemized in the same manner as prescribed herein for Contractor.

f. **Allowance for overhead:** This is defined as costs of any kind attributable to direct and indirect delay, acceleration, or impact, added to the total cost to Owner of any change in the Contract Sum. If the Contractor is compensated under Section 7.03D, the amount of such compensation shall be reduced by the amount Contractor is otherwise entitled to under this subsection (f). This allowance shall compensate Contractor for all noncraft labor, temporary construction facilities, field engineering, schedule updating, as-built drawings, home office cost, B&O taxes, office engineering, estimating costs, additional overhead because of extended time, and any other cost incidental to the change in the Work. It shall be strictly limited in all cases to a reasonable amount, mutually acceptable, or if none can be agreed upon to an amount not to exceed the rates below:

1. **Projects less than $3 million:** For projects where the Contract Award Amount is under $3 million, the following shall apply:
(a) **Contractor markup on Contractor Work:** For Contractor, for any Work actually performed by Contractor’s own forces, 16% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

(b) **Subcontractor markup for Subcontractor Work:** For each Subcontractor (including lower tier subcontractors), for any Work actually performed by its own forces, 16% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

(c) **Contractor markup for Subcontractor Work:** For Contractor, for any work performed by its Subcontractor(s) 6% of the first $50,000 of the amount due each Subcontractor, and 4% of the remaining amount if any.

(d) **Subcontractor markup for lower tier Subcontractor Work:** For each Subcontractor, for any Work performed by its Subcontractor(s) of any lower tier, 4% of the first $50,000 of the amount due the sub-Subcontractor, and 2% of the remaining amount if any.

(e) **Basis of cost applicable for markup:** The cost to which overhead is to be applied shall be developed in accordance with Section 7.02B 7a. – e.

(2). **Projects more than $3 million:** For projects where the Contract Award Amount is equal to or exceeds $3 million, the following shall apply:

(a) **Contractor markup on Contractor Work:** For Contractor, for any Work actually performed by Contractor’s own forces, 12% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

(b) **Subcontractor markup for Subcontractor Work:** For each Subcontractor (including lower tier subcontractors), for any Work actually performed by its own forces, 12% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

(c) **Contractor markup for Subcontractor Work:** For Contractor, for any Work performed by its Subcontractor(s) 4% of the first $50,000 of the amount due each Subcontractor, and 2% of the remaining amount if any.

(d) **Subcontractor markup for lower tier Subcontractor Work:** For each Subcontractor, for any Work performed by its Subcontractor(s) of any lower tier, 4% of the first $50,000 of the amount due the sub-Subcontractor, and 2% of the remaining amount if any.

(e) **Basis of cost applicable for markup:** The cost to which overhead is to be applied shall be developed in accordance with Section 7.02B 7a. – e.

g. **Allowance for profit:** Allowance for profit is an amount to be added to the cost of any change in contract sum, but not to the cost of change in Contract Time for which contractor has been compensated pursuant to the conditions set forth in Section 7.03. It shall be limited to a reasonable amount, mutually acceptable, or if none can be agreed upon, to an amount not to exceed the rates below:

(1) **Contractor / Subcontractor markup for self-performed Work:** For Contractor or Subcontractor of any tier for work performed by their forces, 6% of the cost developed in accordance with Section 7.02B 7a. – e.
(2) Contractor / Subcontractor markup for Work performed at lower tier: For Contractor or Subcontractor of any tier for work performed by a subcontractor of a lower tier, 4% of the subcontract cost developed in accordance with Section 7.02B 7a. – h.

h. Insurance and bond premiums: Cost of change in insurance or bond premium: This is defined as:

(1) Contractor’s liability insurance: The cost of any changes in Contractor’s liability insurance arising directly from execution of the Change Order; and

(2) Payment and Performance Bond: The cost of the additional premium for Contractor’s bond arising directly from the changed Work.

The cost of any change in insurance or bond premium shall be added after overhead and allowance for profit are calculated in accordance with subparagraph f. and g above.

C. Change Order Pricing – Unit Prices

1. Content of Owner authorization: Whenever Owner authorizes Contractor to perform Work on a unit-price basis, Owner’s authorization shall clearly state:

a. Scope: Scope of work to be performed;

b. Reimbursement basis: Type of reimbursement including pre-agreed rates for material quantities; and

c. Reimbursement limit: Cost limit of reimbursement.

2. Contractor responsibilities: Contractor shall:

a. Cooperate with Owner and assist in monitoring the Work being performed. As requested by Owner, Contractor shall identify workers assigned to the Change Order Work and areas in which they are working;

b. Leave access as appropriate for quantity measurement; and

c. Not exceed any cost limit(s) without Owner’s prior written approval.

3. Cost breakdown consistent with Fixed Price requirements: Contractor shall submit costs in accordance with paragraph 7.02B and satisfy the following requirements:

a. Unit prices must include overhead, profit, bond and insurance premiums: Unit prices shall include reimbursement for all direct and indirect costs of the Work, including overhead, profit, bond, and insurance costs; and

b. Owner verification of quantities: Quantities must be supported by field measurement statements signed by Owner.

D. Change Order Pricing – Time-and-Material Prices

1. Content of Owner authorization: Whenever Owner authorizes Contractor to perform Work on a time-and-material basis, Owner’s authorization shall clearly state:

a. Scope: Scope of Work to be performed;
b. **Reimbursement basis**: Type of reimbursement including pre-agreed rates, if any, for material quantities or labor; and

c. **Reimbursement limit**: Cost limit of reimbursement.

2. **Contractor responsibilities**: Contractor shall:

a. **Identify workers assigned**: Cooperate with Owner and assist in monitoring the Work being performed. As requested by Owner, identify workers assigned to the Change Order Work and areas in which they are working;

b. **Provide daily timesheets**: Identify on daily time sheets all labor performed in accordance with this authorization. Submit copies of daily time sheets within 2 working days for Owner’s review.

c. **Allow Owner to measure quantities**: Leave access as appropriate for quantity measurement;

d. **Perform Work efficiently**: Perform all Work in accordance with this section as efficiently as possible; and

e. **Not exceed Owner’s cost limit**: Not exceed any cost limit(s) without Owner’s prior written approval.

3. **Cost breakdown consistent with Fixed Price requirements**: Contractor shall submit costs in accordance with paragraph 7.02B and additional verification supported by:

a. **Timesheets**: Labor detailed on daily time sheets; and

b. **Invoices**: Invoices for material.

### 7.03 CHANGE IN THE CONTRACT TIME

A. **COP requests for Contract Time**: The Contract Time shall only be changed by a Change Order. Contractor shall include any request for a change in the Contract Time in its Change Order Proposal.

B. **Time extension permitted if not Contractor’s fault**: If the time of Contractor’s performance is changed due to an act of Force Majeure, or due to the fault or negligence of Owner or anyone for whose acts Owner is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Time in accordance with the following procedure. No adjustment in the Contract Time shall be allowed to the extent Contractor’s changed time of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible.

1. **Notice and record keeping for Contract Time request**: A request for an equitable adjustment in the Contract Time shall be based on written notice delivered within 7 Days of the occurrence of the event giving rise to the request. If Contractor believes it is entitled to adjustment of Contract Time, Contractor shall immediately notify Owner and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Owner access to any such record and if requested, shall promptly furnish copies of such record to Owner.

2. **Timing and content of Contractor’s Notice**: Contractor shall not be entitled to an adjustment in the Contract Time for any events that occurred more than 7 Days before Contractor’s written notice to Owner. The written notice shall set forth, at a minimum, a description of: the event giving rise to the request for an equitable adjustment in the
Contract Time; the nature of the impacts to Contractor and its Subcontractors of any tier, if any; and to the extent possible the amount of the adjustment in Contract Time requested. Failure to properly give such written notice shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

3. **Contractor to provide supplemental information:** Within 30 Days of the occurrence of the event giving rise to the request, unless Owner agrees in writing to allow an additional period of time to ascertain more accurate data, Contractor shall supplement the written notice provided in accordance with subparagraph 7.03B.2 with additional supporting data. Such additional data shall include, at a minimum: the amount of delay claimed, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the delay claimed, but that the delay claimed was actually a result of the act, event, or condition complained of, and that the Contract Documents provide entitlement to an equitable adjustment in Contract Time for such act, event, or condition; and supporting documentation sufficiently detailed to permit an informed analysis of the request by Owner. Failure to provide such additional information and documentation within the time allowed or within the format required shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

4. **Contractor to proceed with Work as directed:** Pending final resolution of any request in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

C. **Contractor to demonstrate impact on critical path of schedule:** Any change in the Contract Time covered by a Change Order, or based on a request for an equitable adjustment in the Contract Time, shall be limited to the change in the critical path of Contractor's schedule attributable to the change of Work or event(s) giving rise to the request for equitable adjustment. Any Change Order Proposal or request for an adjustment in the Contract Time shall demonstrate the impact on the critical path of the schedule. Contractor shall be responsible for showing clearly on the Progress Schedule that the change or event: had a specific impact on the critical path, and except in case of concurrent delay, was the sole cause of such impact; and could not have been avoided by resequencing of the Work or other reasonable alternatives.

D. **Cost of change in Contract Time:** Contractor may request compensation for the cost of a change in Contract Time in accordance with this paragraph, 7.03D, subject to the following conditions:

1. **Must be solely fault of Owner or A/E:** The change in Contract Time shall solely be caused by the fault or negligence of Owner or A/E;

2. **Procedures:** Contractor shall follow the procedure set forth in paragraph 7.03B;

3. **Demonstrate impact on critical path:** Contractor shall establish the extent of the change in Contract Time in accordance with paragraph 7.03C; and

4. **Limitations on daily costs:** The daily cost of any change in Contract Time shall be limited to the items below, less the amount of any change in the Contract Sum the Contractor may otherwise be entitled to pursuant to Section 7.02B 7f for any change in the Work that contributed to this change in Contract Time:

   a. **Non-productive supervision or labor:** cost of nonproductive field supervision or labor extended because of delay;

   b. **Weekly meetings and indirect activities:** cost of weekly meetings or similar indirect activities extended because of the delay;
c. **Temporary facilities or equipment rental**: cost of temporary facilities or equipment rental extended because of the delay;

d. **Insurance premiums**: cost of insurance extended because of the delay;

e. **Overhead**: general and administrative overhead in an amount to be agreed upon, but not to exceed 3% of the Contract Award Amount divided by the originally specified Contract Time for each Day of the delay.

**PART 8 – CLAIMS AND DISPUTE RESOLUTION**

**8.01 CLAIMS PROCEDURE**

A. **Claim is Contractor's remedy**: If the parties fail to reach agreement on the terms of any Change Order for Owner-directed Work as provided in Section 7.01, or on the resolution of any request for an equitable adjustment in the Contract Sum as provided in Section 7.02 or the Contract Time as provided in Section 7.03, Contractor’s only remedy shall be to file a Claim with Owner as provided in this section.

B. **Claim filing deadline for Contractor**: Contractor shall file its Claim within 120 Days from Owner's final offer made in accordance with paragraph 7.01E, or by the date of Final Acceptance, whichever occurs first.

C. **Claim must cover all costs and be documented**: The Claim shall be deemed to cover all changes in cost and time (including direct, indirect, impact, and consequential) to which Contractor may be entitled. It shall be fully substantiated and documented. At a minimum, the Claim shall contain the following information:

1. **Factual statement of Claim**: A detailed factual statement of the Claim for additional compensation and time, if any, providing all necessary dates, locations, and items of Work affected by the Claim;

2. **Dates**: The date on which facts arose which gave rise to the Claim;

3. **Owner and A/E employee's knowledgeable about Claim**: The name of each employee of Owner or A/E knowledgeable about the Claim;

4. **Support from Contract Documents**: The specific provisions of the Contract Documents which support the Claim;

5. **Identification of other supporting information**: The identification of any documents and the substance of any oral communications that support the Claim;

6. **Copies of supporting documentation**: Copies of any identified documents, other than the Contract Documents, that support the Claim;

7. **Details on Claim for Contract Time**: If an adjustment in the Contract Time is sought: the specific days and dates for which it is sought; the specific reasons Contractor believes an extension in the Contract Time should be granted; and Contractor's analysis of its Progress Schedule to demonstrate the reason for the extension in Contract Time;

8. **Details on Claim for adjustment of Contract Sum**: If an adjustment in the Contract Sum is sought, the exact amount sought and a breakdown of that amount into the categories set forth in, and in the detail as required by Section 7.02; and
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9. **Statement certifying Claim:** A statement certifying, under penalty of perjury, that the Claim is made in good faith, that the supporting cost and pricing data are true and accurate to the best of Contractor’s knowledge and belief, that the Claim is fully supported by the accompanying data, and that the amount requested accurately reflects the adjustment in the Contract Sum or Contract Time for which Contractor believes Owner is liable.

D. **Owner’s response to Claim filed:** After Contractor has submitted a fully documented Claim that complies with all applicable provisions of Parts 7 and 8, Owner shall respond, in writing, to Contractor as follows:

1. **Response time for Claim less than $50,000:** If the Claim amount is less than $50,000, with a decision within 60 Days from the date the Claim is received; or

2. **Response time for Claim of $50,000 or more:** If the Claim amount is $50,000 or more, with a decision within 60 Days from the date the Claim is received, or with notice to Contractor of the date by which it will render its decision. Owner will then respond with a written decision in such additional time.

E. **Owner’s review of Claim and finality of decision:** To assist in the review of Contractor’s Claim, Owner may visit the Project site, or request additional information, in order to fully evaluate the issues raised by the Claim. Contractor shall proceed with performance of the Work pending final resolution of any Claim. Owner’s written decision as set forth above shall be final and conclusive as to all matters set forth in the Claim, unless Contractor follows the procedure set forth in Section 8.02.

F. **Waiver of Contractor rights for failure to comply with this Section:** Any Claim of the Contractor against the Owner for damages, additional compensation, or additional time, shall be conclusively deemed to have been waived by the Contractor unless made in accordance with the requirements of this Section.

8.02 **ARBITRATION**

A. **Timing of Contractor’s demand for arbitration:** If Contractor disagrees with Owner’s decision rendered in accordance with paragraph 8.01D, Contractor shall provide Owner with a written demand for arbitration. No demand for arbitration of any such Claim shall be made later than 30 Days after the date of Owner’s decision on such Claim; failure to demand arbitration within said 30 Day period shall result in Owner’s decision being final and binding upon Contractor and its Subcontractors.

B. **Filing of Notice for arbitration:** Notice of the demand for arbitration shall be filed with the American Arbitration Association (AAA), with a copy provided to Owner. The parties shall negotiate or mediate under the Voluntary Construction Mediation Rules of the AAA, or mutually acceptable service, before seeking arbitration in accordance with the Construction Industry Arbitration Rules of AAA as follows:

1. **Claims less than $30,000:** Disputes involving $30,000 or less shall be conducted in accordance with the Northwest Region Expedited Commercial Arbitration Rules; or

2. **Claims greater than $30,000:** Disputes over $30,000 shall be conducted in accordance with the Construction Industry Arbitration Rules of the AAA, unless the parties agree to use the expedited rules.

C. **Arbitration is forum for resolving Claims:** All Claims arising out of the Work shall be resolved by arbitration. The judgment upon the arbitration award may be entered, or review of the award may
occur, in the superior court having jurisdiction thereof. No independent legal action relating to or arising from the Work shall be maintained.

D. **Owner may combine Claims into same arbitration:** Claims between Owner and Contractor, Contractor and its Subcontractors, Contractor and A/E, and Owner and A/E shall, upon demand by Owner, be submitted in the same arbitration or mediation.

E. **Settlement outside of arbitration to be documented in Change Order:** If the parties resolve the Claim prior to arbitration judgment, the terms of the resolution shall be incorporated in a Change Order. The Change Order shall constitute full payment and final settlement of the Claim, including all claims for time and for direct, indirect, or consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity.

**8.03 CLAIMS AUDITS**

A. **Owner may audit Claims:** All Claims filed against Owner shall be subject to audit at any time following the filing of the Claim. Failure of Contractor, or Subcontractors of any tier, to maintain and retain sufficient records to allow Owner to verify all or a portion of the Claim or to permit Owner access to the books and records of Contractor, or Subcontractors of any tier, shall constitute a waiver of the Claim and shall bar any recovery.

B. **Contractor to make documents available:** In support of Owner audit of any Claim, Contractor shall, upon request, promptly make available to Owner the following documents:

1. Daily time sheets and supervisor's daily reports;
2. Collective bargaining agreements;
3. Insurance, welfare, and benefits records;
4. Payroll registers;
5. Earnings records;
6. Payroll tax forms;
7. Material invoices, requisitions, and delivery confirmations;
8. Material cost distribution worksheet;
9. Equipment records (list of company equipment, rates, etc.);
10. Vendors', rental agencies', Subcontractors', and agents' invoices;
11. Contracts between Contractor and each of its Subcontractors, and all lower-tier Subcontractor contracts and supplier contracts;
12. Subcontractors' and agents' payment certificates;
13. Cancelled checks (payroll and vendors);
14. Job cost report, including monthly totals;
15. Job payroll ledger;
16. Planned resource loading schedules and summaries;
17. General ledger;
18. Cash disbursements journal;
19. Financial statements for all years reflecting the operations on the Work. In addition, the Owner may require, if it deems it appropriate, additional financial statements for 3 years preceding execution of the Work;
20. Depreciation records on all company equipment whether these records are maintained by the company involved, its accountant, or others;
21. If a source other than depreciation records is used to develop costs for Contractor’s internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents;
22. All nonprivileged documents which relate to each and every Claim together with all documents which support the amount of any adjustment in Contract Sum or Contract Time sought by each Claim;
23. Work sheets or software used to prepare the Claim establishing the cost components for items of the Claim including but not limited to labor, benefits and insurance, materials, equipment, Subcontractors, all documents which establish the time periods, individuals involved, the hours for the individuals, and the rates for the individuals; and
24. Work sheets, software, and all other documents used by Contractor to prepare its bid.

C. Contractor to provide facilities for audit and shall cooperate: The audit may be performed by employees of Owner or a representative of Owner. Contractor, and its Subcontractors, shall provide adequate facilities acceptable to Owner, for the audit during normal business hours. Contractor, and all Subcontractors, shall make a good faith effort to cooperate with Owner’s auditors.

PART 9 – TERMINATION OF THE WORK

9.01 TERMINATION BY OWNER FOR CAUSE

A. 7 Day Notice to Terminate for Cause: Owner may, upon 7 Days written notice to Contractor and to its surety, terminate (without prejudice to any right or remedy of Owner) the Work, or any part of it, for cause upon the occurrence of any one or more of the following events:

1. Contractor fails to prosecute Work: Contractor fails to prosecute the Work or any portion thereof with sufficient diligence to ensure Substantial Completion of the Work within the Contract Time;
2. Contractor bankrupt: Contractor is adjudged bankrupt, makes a general assignment for the benefit of its creditors, or a receiver is appointed on account of its insolvency;
3. Contractor fails to correct Work: Contractor fails in a material way to replace or correct Work not in conformance with the Contract Documents;
4. Contractor fails to supply workers or materials: Contractor repeatedly fails to supply skilled workers or proper materials or equipment;
5. Contractor failure to pay Subcontractors or labor: Contractor repeatedly fails to make prompt payment due to Subcontractors or for labor;
6. **Contractor violates laws:** Contractor materially disregards or fails to comply with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction; or

7. **Contractor in material breach of Contract:** Contractor is otherwise in material breach of any provision of the Contract Documents.

B. **Owner’s actions upon termination:** Upon termination, Owner may at its option:

   1. **Take possession of Project site:** Take possession of the Project site and take possession of or use all materials, equipment, tools, and construction equipment and machinery thereon owned by Contractor to maintain the orderly progress of, and to finish, the Work;

   2. **Accept assignment of Subcontracts:** Accept assignment of subcontracts pursuant to Section 5.20; and

   3. **Finish the Work:** Finish the Work by whatever other reasonable method it deems expedient.

C. **Surety’s role:** Owner’s rights and duties upon termination are subject to the prior rights and duties of the surety, if any, obligated under any bond provided in accordance with the Contract Documents.

D. **Contractor’s required actions:** When Owner terminates the Work in accordance with this section, Contractor shall take the actions set forth in paragraph 9.02B, and shall not be entitled to receive further payment until the Work is accepted.

E. **Contractor to pay for unfinished Work:** If the unpaid balance of the Contract Sum exceeds the cost of finishing the Work, including compensation for A/E’s services and expenses made necessary thereby and any other extra costs or damages incurred by Owner in completing the Work, or as a result of Contractor’s actions, such excess shall be paid to Contractor. If such costs exceed the unpaid balance, Contractor shall pay the difference to Owner. These obligations for payment shall survive termination.

F. **Contractor and Surety still responsible for Work performed:** Termination of the Work in accordance with this section shall not relieve Contractor or its surety of any responsibilities for Work performed.

G. **Conversion of “Termination for Cause” to “Termination for Convenience”:** If Owner terminates Contractor for cause and it is later determined that none of the circumstances set forth in paragraph 9.01A exist, then such termination shall be deemed a termination for convenience pursuant to Section 9.02.

9.02 **TERMINATION BY OWNER FOR CONVENIENCE**

A. **Owner Notice of Termination for Convenience:** Owner may, upon written notice, terminate (without prejudice to any right or remedy of Owner) the Work, or any part of it, for the convenience of Owner.

B. **Contractor response to termination Notice:** Unless Owner directs otherwise, after receipt of a written notice of termination for either cause or convenience, Contractor shall promptly:

   1. **Cease Work:** Stop performing Work on the date and as specified in the notice of termination;
2. No further orders or Subcontracts: Place no further orders or subcontracts for materials, equipment, services or facilities, except as may be necessary for completion of such portion of the Work as is not terminated;

3. Cancel orders and Subcontracts: Cancel all orders and subcontracts, upon terms acceptable to Owner, to the extent that they relate to the performance of Work terminated;

4. Assign orders and Subcontracts to Owner: Assign to Owner all of the right, title, and interest of Contractor in all orders and subcontracts;

5. Take action to protect the Work: Take such action as may be necessary or as directed by Owner to preserve and protect the Work, Project site, and any other property related to this Project in the possession of Contractor in which Owner has an interest; and

6. Continue performance not terminated: Continue performance only to the extent not terminated

C. Terms of adjustment in Contract Sum if Contract terminated: If Owner terminates the Work or any portion thereof for convenience, Contractor shall be entitled to make a request for an equitable adjustment for its reasonable direct costs incurred prior to the effective date of the termination, plus reasonable allowance for overhead and profit on Work performed prior to termination, plus the reasonable administrative costs of the termination, but shall not be entitled to any other costs or damages, whatsoever, provided however, the total sum payable upon termination shall not exceed the Contract Sum reduced by prior payments. Contractor shall be required to make its request in accordance with the provisions of Part 7.

D. Owner to determine whether to adjust Contract Time: If Owner terminates the Work or any portion thereof for convenience, the Contract Time shall be adjusted as determined by Owner.

PART 10 – MISCELLANEOUS PROVISIONS

10.01 GOVERNING LAW

Applicable law and venue: The Contract Documents and the rights of the parties herein shall be governed by the laws of the state of Washington. Venue shall be in the county in which Owner’s principal place of business is located, unless otherwise specified.

10.02 SUCCESSORS AND ASSIGNS

Bound to successors; Assignment of Contract: Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party hereto and to partners, successors, assigns, and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents. Neither party shall assign the Work without written consent of the other, except that Contractor may assign the Work for security purposes, to a bank or lending institution authorized to do business in the state of Washington. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations set forth in the Contract Documents.

10.03 MEANING OF WORDS

Meaning of words used in Specifications: Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings. Reference to standard specifications, manuals, or codes of any technical society, organization, or association, or to the code of any governmental authority,
whether such reference be specific or by implication, shall be to the latest standard specification, manual, or code in effect on the date for submission of bids, except as may be otherwise specifically stated. Wherever in these Drawings and Specifications an article, device, or piece of equipment is referred to in the singular manner, such reference shall apply to as many such articles as are shown on the drawings, or required to complete the installation.

10.04 RIGHTS AND REMEDIES

No waiver of rights: No action or failure to act by Owner or A/E shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall action or failure to act constitute approval or an acquiescence in a breach therein, except as may be specifically agreed in writing.

10.05 CONTRACTOR REGISTRATION

Contractor must be registered or licensed: Pursuant to RCW 39.06, Contractor shall be registered or licensed as required by the laws of the State of Washington, including but not limited to RCW 18.27.

10.06 TIME COMPUTATIONS

Computing time: When computing any period of time, the day of the event from which the period of time begins shall not be counted. The last day is counted unless it falls on a weekend or legal holiday, in which event the period runs until the end of the next day that is not a weekend or holiday. When the period of time allowed is less than 7 days, intermediate Saturdays, Sundays, and legal holidays are excluded from the computation.

10.07 RECORDS RETENTION

Six year records retention period: The wage, payroll, and cost records of Contractor, and its Subcontractors, and all records subject to audit in accordance with Section 8.03, shall be retained for a period of not less than 6 years after the date of Final Acceptance.

10.08 THIRD-PARTY AGREEMENTS

No third party relationships created: The Contract Documents shall not be construed to create a contractual relationship of any kind between: A/E and Contractor; Owner and any Subcontractor; or any persons other than Owner and Contractor.

10.09 ANTITRUST ASSIGNMENT

Contractor assigns overcharge amounts to Owner: Owner and Contractor recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact usually borne by the purchaser. Therefore, Contractor hereby assigns to Owner any and all claims for such overcharges as to goods, materials, and equipment purchased in connection with the Work performed in accordance with the Contract Documents, except as to overcharges which result from antitrust violations commencing after the Contract Sum is established and which are not passed on to Owner under a Change Order. Contractor shall put a similar clause in its Subcontracts, and require a similar clause in its sub-Subcontracts, such that all claims for such overcharges on the Work are passed to Owner by Contractor.

10.10 HEADINGS AND CAPTIONS

Headings for convenience only: All headings and captions used in these General Conditions are only for convenience of reference, and shall not be used in any way in connection with the meaning, effect, interpretation, construction, or enforcement of the General Conditions, and do not define the limit or describe the scope or intent of any provision of these General Conditions.
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These University of Washington Modifications to the General Conditions form a part of, and are incorporated in the Contract Documents and modify, delete, add, and replace provisions of the General Conditions. Provisions not altered remain in effect. All terms defined elsewhere in the Contract Documents shall have the same meaning here.

PART 1 – GENERAL PROVISIONS

1.01 DEFINITIONS

Add the following definitions:

**Certified Business Enterprise (CBE):** Any business enterprise certified with the Washington State Office of Minority and Women’s Business Enterprises (OMWBE), Northwest Mountain Minority Supplier Diversity Council (NWMMSDC), or Women’s Business Enterprise Council (WBEC).

**Lesbian/Gay/Bisexual/Transgender Business Enterprise (LGBTBE):** More than 50% owned and controlled by at least one person who is a member of the LGBT community.

**Minority Business Enterprise (MBE):** More than 50% owned and controlled by at least one person who is a member of one or more of the following minority groups:

- Asian Pacific American
- Black American
- Hispanic American
- Native American
- Subcontinent Asian American

**Minority Women’s Business Enterprise (MWBE):** More than 50% owned and controlled by at least one woman who is a member of one or more of the above minority groups.

**Small Business Enterprise (SBE):** A business entity that:

- Can attest that it is owned and operated independently from all other businesses and
- Conforms to the U.S. Small Business Administration Size Standards of the North American Industry Classification System (NAICS) Codes in which it is to be engaged at the UW; or
- Is certified with the OMWBE.

**Veteran’s Business Enterprise (VBE):** Certified with the Washington State Department of Veteran’s Affairs (DVA)

**Women’s Business Enterprise (WBE):** More than 50% owned and controlled by one or more women.

PART 2 – INSURANCE AND BONDS

2.01 Contractor’s Liability Insurance
• Add the following language to the end of the first paragraph of section 2.01:

“The certificate holder shall be:
UW Facilities, Project Delivery Group
University of Washington
Box 352205
Seattle, WA 98195”

A policy for Commercial General Liability Insurance which includes coverage for bodily injury, property damage, premises operations, independent contracts, and broad-form contractual liability, and Stop Gap, unless as Employer Liability under Part B of Worker’s Compensation Insurance Policy.

Products Completed Operations Additional Insured. The Contractor’s CGL insurance must include the Owner as an additional insured status on ISO CG 20 10 11 85 or CG 20 37 endorsement, or by an equivalent policy or endorsement provisions. The Product Completed Operations additional insured status for the Owner must remain in effect for not less than 3 years following Final Completion.

• Delete subparagraph 2.01A2 and replace it with the following language:

“Automobile Liability Insurance:
Commercial Automobile Liability with a combined single limited of not less than $1,000,000 for each accident. Coverage shall include Bodily Injury and Property Damage Liability for all owned, non-owned, leased, and hired automobiles and contain a Waiver of Subrogation in favor of the Owner. If pollutants are to be transported, MCS 90 and CA 99 48 endorsements are required on the Automobile Liability policy unless the transportation pollution risk covered under a Pollution Liability insurance policy carried by the Contractor.

• Delete paragraph 2.01D and replace it with the following language:

“Owner as Additional Insured: All insurance coverages shall name the Board of Regents of the University of Washington as an additional insured with respect to liability arising out of work performed by Contractor, and an additional insured endorsement to the policy must be provided to the Owner. All insurance coverages shall be endorsed to be primary and non-contributory with any insurance maintained by the University of Washington, provide a waiver of any rights of subrogation against the University of Washington, and contain a severability of interest provision in favor of the University of Washington, and all insurance certificates shall evidence full compliance with the enumerated requirements. If the contract amount, including alternates, is less than $5 million, the primary and non-contributory endorsement is not mandatory.”

The Contractor must provide a Pollution Liability policy for pollutants that are or may be remediated on or off site covering claims, including investigation, defense, or settlement costs and expenses that involve bodily injury and property damage (including natural resources damages and loss of use of tangible property that has not been physically injured) covering:

Pollution conditions caused or made worse by the Contractor, including clean-up costs for a newly caused condition or a historical condition that is made worse the vicarious liability of subcontractors of any tier.

The Pollution Liability insurance must provide a minimum limit of liability of $1,000,000 each claim with a minimum aggregate limit of 200% of the each claim limit. There is no requirement for a dedicated project aggregate limit provided that the Contractor (1) submits to the Owner before the Notice to Proceed Date with its insurance certification a written statement from its authorized insurance representative that the full minimum aggregate limit is available and has
not been impaired by any claims reserved on another project, and (2) thereafter, until the
completion of the Work, provides notice in writing to the City within 10 Days of Contractor's
constructive knowledge of any pending or actual impairment of the aggregate limit. If in-Transit
Pollution Liability is required but is not provided under the Automobile Liability, the Contractor
must provide evidence of transportation coverage under the Contractor’s Pollution Liability
policy.

2.04 Payment and Performance Bonds

- Delete the last sentence of section 2.04 and replace it with the following language:
  “No payment or performance bond is required if the Contract Sum is $150,000 or less and
  Contractor agrees that Owner may, in lieu of the bond, retain 10% of the Contract Sum for the
  period allowed by RCW 39.08.010.”

PART 5 - PERFORMANCE

5.01 Contractor Control and Supervision

Add a new paragraph 5.01G as follows:

“Work During Off Hours: When work is to be performed during other than normal working hours or
on University of Washington holidays, Contractor shall give Owner prior notice so that Owner's
Police Department may be properly notified. Any construction activity between the hours of 10:00
p.m. to 6:00 a.m. is subject to approval of Owner.”

Add a new paragraph 5.01H as follows:

“Contractor to comply with University of Washington’s campus conduct code: Contractor shall
ensure that its owner(s) and employees, and those of its Subcontractors, comply with the
University’s conduct on campus code, WAC 478-124-020, which, among other things, prohibits
the possession or use of firearms or other dangerous weapons or instrumentalities on the
University campus, except for authorized University purposes. At the discretion of the University,
Contractor shall remove from the University campus, at its sole cost and expense, any of its, or its
Subcontractors’ employees, if they are in violation of this code.”

5.02 Permits, Fees and Notice

Add a new paragraph 5.02D as follows:

“For Work within the City of Seattle, Owner shall pay the City of Seattle directly for the cost of the
Master Use and Building Permit. Prior to Final Acceptance, the building permit and City-approved
drawings, signed inspection card(s), and any appropriate occupancy permits shall be submitted to
Owner.”

5.07 Safety Precautions

- Add a new paragraph 5.07I as follows:

“1. A copy of its company Safety Program. The Safety Program shall contain, at a minimum,
the following:

   a. Organization, including names of individuals who will perform safety duties, titles, work
assignments, authority and reporting relationships.”
b. Training Program. Who, how and when training is provided; method of employee training concerning safety rules and procedures; training in use of protective equipment.

c. Protective Equipment. List of personal protective equipment to be provided to employees.

d. Accident Prevention and Loss Control Plan. Work site inspection and hazard correction procedures; disciplinary procedures for safety infractions; accident response, investigation and reporting procedures.

e. Regular Safety Meetings. On-site weekly or other frequency as appropriate, safety meetings mandatory for all employees."

• Add a new paragraph 5.07J as follows:

"Prior to commencing any Work on-site, Contractor shall submit an appropriate site specific safety plan for Owner’s acceptance. The plan must be tailored to the needs of the particular project and to the types of hazards involved, and be in compliance with WISHA requirements. Contractor shall not begin any on-site Work until the site specific safety plan has been accepted by Owner."

• Add a new paragraph 5.07K

"With its monthly Application for Payment, the Contractor shall submit the Monthly Safety report on the form in Appendix A.

5.10 Unforeseen Physical Conditions

Add a new paragraph 5.10C as follows:

"If Contractor encounters mold in the course of its work it shall notify Owner to evaluate what action might be necessary. Contractor shall ensure that all building materials used during the work are dry prior to incorporation into the Work. If Contractor encounters water intrusion from any source it shall take immediate steps to ensure that any effected material is dry according to generally accepted industry standards."

5.13 Material and Equipment

Add the following new sentence after the last sentence of paragraph 5.13A:

"Contractor shall ensure that all equipment, materials and articles incorporated into the Work shall be asbestos free."

5.20 Subcontractors and Suppliers

Add the following new subparagraph 5.20A6 as follows:

"For contracts entered into between September 1, 2010 and December 31, 2013, not have violated the reporting requirements of RCW 39.04.370 more than one time, as determined by the Department of Labor and Industries."

5.23 Contractor Performance Evaluation

Add a new section 5.23 as follows:
“CONTRACTOR PERFORMANCE EVALUATION

Owner shall evaluate Contractor for the performance categories as set forth in the “Contractor Performance Evaluation Report” in Appendix A. Section 00 73 20, Contractor Performance Evaluation Program, describes the evaluation process.”

PART 6 – PAYMENTS AND COMPLETION

6.07 Substantial Completion

Delete the second sentence of paragraph 6.07 and replace it with the following language:

“All Work other than incidental corrective and incidental punch list work shall be completed.”

PART 7 – CHANGES

7.02 Change in the Contract Sum

- Add the following new sentence after the second sentence of subparagraph 7.02B7a:

  “When estimating labor hours for electrical work, such hours shall be no greater than the Labor Units for specific items included in the “Normal” project conditions column of the NECA Manual of Labor Units, most recent edition. When estimating labor hours for mechanical work, such hours shall be no greater than 75% of the Labor Units for specific items included in the MCAA Web-Based Estimating Manual (WebLEM), subject to the assumptions and notes in the WebLEM, except that the Labor Units for “Hangers, Sleeves, & Inserts” shall be no greater than 50% of the WebLEM Labor Units. Special exceptions for electrical and mechanical work may be made for work having to be performed under extraordinary conditions. Such exceptions shall be identified and explained in any applicable pricing proposals and shall be subject to approval by Owner.”

- Delete the last sentence of subparagraph 7.02B7a(1) and replace it with the following:

  “No supervision markup shall be allowed in a Change Order that contains direct labor costs for a working supervisor’s hours (including any category of foreman).”

- Replace subparagraph 7.02B7b in its entirety with the following:

  “Material costs: This is an itemization of the quantity and cost of materials needed to perform the change in the Work. Material costs shall be developed first from actual known costs, including, but not limited to, Contractors’ supplier(s)’ actual cost(s) available from the standard industry pricing guide “Trade Service”, second from supplier quotations, or, if these are not available, and third from other standard industry pricing guides.

  Material costs shall include all available discounts. Freight costs, express charges, or special delivery charges, shall be itemized.”

- Add the following new language after the second sentence of subparagraph 7.02B7c:
“The Contractor’s cost for utility vehicles and other items such as pickup trucks, vans, flatbed trucks, storage trailers, containers, etc., that are already in use or planned for use on the Project will not be compensated in Change Order work except for the time that, in the opinion of the Owner, such items: (1) are directly and necessarily used for the performance of the change work; and (2) the cost of using such items has not been included within the Contractor’s total project overhead costs.”

- Add the following new language after the last sentence of subparagraph 7.02B7c(2):
  “Equipment pricing shall be no greater than 75% of NECA monthly rates.”

- Delete the first sentence of subparagraph 7.02B7d and replace it with the following language:
  “Small tools consist of tools which cost $1,000 or less and are normally furnished by the performing contractor.”

PART 8 - CLAIMS AND DISPUTE RESOLUTION

8.02 Replace section 8.02 in its entirety with the following:

“LITIGATION

A. If Contractor disagrees with Owner's decision rendered in accordance with paragraph 8.01D, Contractor shall serve and file a lawsuit in an appropriate court within 120 days of Owner's decision. This requirement cannot be waived except by an explicit waiver signed by Owner. The failure to file a lawsuit within said 120-day period shall result in Owner's decision rendered in accordance with paragraph 8.01D being final and binding on Contractor and all of its Subcontractors.

B. At any time, either before or after a lawsuit has been commenced by Contractor in accordance with paragraph 8.02A, Owner may require Contractor to participate in further mediation or arbitration, or both, in any forum or format as determined by Owner.

C. Claims between Owner and Contractor, Contractor and its Subcontractors, Contractor and A/E, and Owner and A/E shall, upon demand by Owner, be submitted in a single forum, or Owner may consolidate such Claims or join any of the above-named parties in the same forum.”

PART 10 - MISCELLANEOUS PROVISIONS

10.11 Add a new section 10.11 as follows:

“Business Equity Requirements

A. General Requirements

Contractor shall conduct business in an equitable and inclusive manner. The University of Washington welcomes the participation of all Business Equity Enterprises (BEE), irrespective of gross revenues, including those that are self-designated and those that are state (OMWBE) certified. Participation may be on a direct basis in response to this invitation to bid, or as a subcontractor or supplier. The University of Washington has set an overall aspirational goal of 20% BEE utilization, inclusive of 15% minority and women-owned business utilization across our public works program.”
Contractor shall comply with the following requirements:

In accordance with Chapter 39.19 RCW, it is the policy of the State of Washington to provide the maximum practicable opportunity for increased participation by minority and women-owned and controlled businesses (MWBE) in public works.

The Washington State Office of Minority and Women’s Business Enterprises (OMWBE) certifies firms that are owned and controlled by minorities or women, and can provide information regarding the certification process. Information about the certification status of a particular firm is available at the following OMWBE website address: http://www.omwbe.wa.gov/biznetwas/, or by contacting OMWBE at (360) 753-9693, 406 South Water, P.O. Box 41160, Olympia, Washington 98504-4611.

B. Inclusion Efforts

1. The identified lowest responsive bidder shall submit, as provided by the Owner, a BEE Contribution Form, along with their Schedule of Values for review. The BEE Contribution Form shall include a project specific BEE inclusion goal and capture the efforts and business practices the Contractor used to ensure that BEEs have the maximum practicable opportunity to participate and be included in the project. The BEE Contribution Form shall be complete and the information in each section shall demonstrate the Contractor's approach to providing these opportunities and the inclusion of BEE. The BEE Contribution Form is subject to review and approval by the Owner. The Owner may request clarification and/or corrections, however, non-responsive or incomplete Forms may be grounds for rejecting the Bidder as not responsible.

2. Contractors shall:
   a. Advertise opportunities for subcontractors or suppliers in a manner reasonably designed to provide BEEs capable of performing the work with timely notice of such opportunities, and all advertisements shall include a provision encouraging participation by BEE firms. Advertising may be done through general advertisements (e.g., newspapers, journals, etc.) or by soliciting bids/proposals directly from BEEs.
   b. Provide BEEs that express interest with adequate and timely information about plans, specifications, schedules, and requirements of the Contract.

3. Contractors are further encouraged to:
   a. Break down work into tasks or quantities that are appropriately sized for the intended subcontractor and/or BEE, in order to permit maximum participation by BEEs and other small businesses.
   b. Establish delivery schedules, where the requirements of this contract permit, that encourage participation by BEEs and other small businesses.
   c. Reduce bonding requirements where practicable.
   d. Utilize the services of available minority community organizations, minority contractor groups, local minority assistance offices and organizations that provide assistance in the recruitment and placement of BEEs and other small businesses.

C. Reporting Requirements
1. With the application for Progress Payment, Contractor shall submit a list of all BEE subcontractors/suppliers paid during the payment period along with any certification or Self-Declaration information. The Owner has provided a BEE Declaration Form, which is to be completed by every subcontractor, supplier, and materialman or similar on the project.

2. Prior to Final Acceptance, Contractor shall submit a report of total dollar amounts paid to BEEs.

D. Non-Discrimination

Contractors shall not create barriers to open and fair opportunities to all businesses including BEEs to participate in University contracts and to obtain or compete for contracts and subcontracts as sources of supplies, equipment, construction and services. In considering offers from and doing business with subcontractors and suppliers, the Contractor shall not discriminate on the basis of race, color, creed, religion, sex, age, nationality, marital status, or the presence of any mental or physical disability in an otherwise qualified disabled person.

E. Sanctions

Failure to comply with any of the mandatory requirements of this part of the contract may subject the Contractor to sanctions or damages as provided for by RCW 39.19.090, or by other applicable laws.

END OF SECTION
These Supplemental Conditions form a part of, and are incorporated in, the Contract Documents and modify, delete, add, and replace provisions of the General Conditions. Provisions not altered remain in effect. All terms defined elsewhere in the Contract Documents shall have the same meaning in these Supplemental Conditions.

00 73 01 TIME OF COMPLETION AND LIQUIDATED DAMAGES

The Work shall be commenced on the effective date specified in the Notice to Proceed and shall be substantially complete within a period not to exceed One hundred twenty-five (125) calendar days. For failure to achieve Substantial Completion of the Work within the time provided, Contractor shall pay Owner $800 for each calendar day from the date when Substantial Completion should have been achieved to the date Substantial Completion is actually achieved. The provisions of the General Conditions section 3.07, for liquidated damages, remain in effect.

00 73 02 CONTRACTOR’S LIABILITY INSURANCE

Not Used

00 73 03 COVERAGE LIMITS

Not Used

00 73 04 BUILDER’S RISK

Delete Section 2.06 A and B and replace with the following new Section 2.06 A:

Owner will purchase and maintain Builder’s Risk property insurance in the amount of the Contract Sum including all Change Orders for the entire Work on a replacement cost basis until Substantial Completion. Contractor shall be responsible for all losses up to the policy deductible amount of $5,000 per occurrence for projects valued at $500,000 or less; and $10,000 per occurrence for projects valued at more than $500,000. A specimen policy is available for inspection. Contractor is not required to obtain Builder’s Risk property insurance. All other provisions of the General Conditions Section 2.06, Builder’s Risk, remain in effect except that Architects and Engineers (A/E’s) and A/E’s Subconsultants are deleted from paragraph C.

If the Contractor believes it has a loss that is covered by Builder’s Risk/Property Insurance, and it is likely to exceed the policy deductible, the Contractor shall notify the Owner within 48 hours.

In Section 2.06, delete the following from paragraph C: “A/E, A/E’s subconsultants” and renumber paragraph C as paragraph B.

00 73 05 CLAIMS AND DISPUTE RESOLUTION

Not Used
00 73 06 PERMITS REQUIRED

- Building Permit is owner provided
- Mechanical by General Contractor
- Electrical by General Contractor
- Plumbing by General Contractor

END OF SECTION
University of Washington

CONTRACTOR PERFORMANCE EVALUATION PROGRAM

I. POLICY

The University of Washington through its Capital Planning and Development service group (Owner), is charged with the responsibility of ensuring that all public works improvement projects are awarded to the responsible bidder submitting the lowest responsive bid, and are performed in compliance with the Contract Documents and applicable federal, state, and local laws and regulations. The Owner is responsible to the citizens of the State to oversee the expenditure of public funds, and to secure the best possible results for that expenditure. To assist the Owner in evaluating a Contractor's responsibility, as well as its performance on contracts of the Owner, the Contractor Performance Evaluation Program has been developed. The implementation of a mandatory, standardized system of evaluating Contractors' performance is expected to yield consistency, objectivity, fairness, and accountability.

II. PURPOSE

The purpose of the Contractor Performance Evaluation Program is to better assure that Contractors considered for contract award on public works projects either possess, or will likely possess at the time contract performance is set to begin, all qualifications necessary to successfully complete the project on time. Among other things, the Program is intended to:

- Assist the Owner in exercising its discretion to determine a Contractor's qualifications and abilities to successfully perform a particular contract.
- Provide the Owner with a rational basis for determining that a Contractor is or is not responsible.
- Provide Contractors with a means of enhancing their qualifications and reputation by receiving recognition for high standards of performance.
- Encourage better working relationships between the Owner and Contractors.
- Provide official, verifiable references for Contractors who may be under consideration for award of, or approval on, contracts to be awarded by other public owners.
- Provide a history and an assessment of a Contractor's performance on prior contracts of the Owner for use in suspension or debarment proceedings.

The Contractor Performance Evaluation Program is not intended to determine whether a Contractor has breached a contract with the Owner, or to determine the acceptability of any particular noncompliance with Contract requirements.

III. PERFORMANCE CATEGORY EVALUATION GUIDE

The Performance Category Evaluation Guide establishes criteria to be used in evaluating the Contractor's performance in connection with each Performance Category, and describes five Performance Levels, which range in ascending order of merit from "Inadequate" to "Superior".
The "Standard" Performance Level is considered a baseline; it characterizes the level of acceptable performance normally associated with a reasonably prudent, diligent, and skilled Contractor working on projects of the same general type and size. Both the "Superior" and "Good" Levels characterize performance levels that exceed the baseline; they respectively connote consistent and substantial positive contributions to the overall project. Both the "Deficient" and "Inadequate" Levels characterize levels of performance that fall below the baseline, and respectively connote substantial and serious detriment to the overall project. The "No Evaluation" Level is to be used only where the Contractor had no direct or indirect responsibility for performance.

The five Performance Levels are more specifically described as follows, and the criteria set forth for each shall be applied in evaluating the Contractor's performance in connection with each of the Performance Categories listed in Section III of the Contractor Performance Evaluation Report:

A. Superior To merit an evaluation of "Superior" in any Performance Category, the Contractor must have consistently demonstrated:

   (1) Command or virtual mastery of the Contract Documents related to that Performance Category;

   (2) Performance of the work or activity being evaluated under that Performance Category that always exceeded or surpassed the material requirements of the Contract;

   (3) A highly cooperative attitude in dealing with Owner’s employees, consultants, and the public in connection with that Performance Category, which attitude made a substantial, positive contribution to the Project; and

   (4) Initiative in carrying out his or her duties in connection with that Performance Category in a responsive, thorough, and timely manner without prompting by the Owner’s Representative.

If the Contractor fails to satisfy any one of the Performance Level criteria set out above, then his or her performance will be re-evaluated under the "Good" Level by applying the criteria for that Level.

B. Good To merit an evaluation of "Good" in any Performance Category, the Contractor must have demonstrated:

   (1) Thorough knowledge of Contract Documents related to that Performance Category;

   (2) Performance of the work or activity being evaluated under that Performance Category that always met, and often exceeded, the material requirements of the Contract;

   (3) A cooperative attitude in dealing with Owner’s employees, consultants, and the public in connection with that Performance Category, which attitude made a positive contribution to the project; and
(4) Initiative in carrying out his or her duties in connection with that Performance Category in a responsive, thorough, and timely manner with only minimal prompting by the Owner’s Representative.

If the Contractor fails to satisfy any one of the Performance Level criteria set out above, then his or her performance will be re-evaluated under the "Standard" Level by applying the criteria for that Level.

C. **Standard** To merit an evaluation of "Standard" in any Performance Category, the Contractor must have demonstrated:

(1) Acceptable knowledge of the Contract Documents related to that Performance Category;

(2) Performance of the work or activity being evaluated under that Performance Category that met all material Contract requirements;

(3) A generally cooperative attitude toward Owner’s employees, consultants, and the public in connection with that Performance Category; and

(4) Initiative in carrying out his or her duties in connection with that Performance Category in a responsive, thorough, and timely manner with only moderate prompting by the Owner's Representative.

If the Contractor fails to satisfy any one of the Performance Level criteria set out above, then his or her performance will be re-evaluated under the "Deficient" and "Inadequate" Levels by applying the criteria for those Levels.

D. **Deficient** To merit an evaluation of "Deficient" in any Performance Category, the Contractor must have demonstrated:

(1) Marginal knowledge of the Contract Documents related to that Performance Category;

(2) Performance of the work or activity being evaluated under that Performance Category that did not always meet the material Contract requirements, and such failures were not excusable as the sole fault and responsibility of one or more other parties;

(3) An occasionally uncooperative attitude toward Owner's employees, consultants, or the public in connection with that Performance Category; or

(4) Performance of his or her duties in connection with that Performance Category in a moderately unresponsive, inattentive, or dilatory manner, or after frequent or repeated prompting by the Owner's Representative.

E. **Inadequate** To merit an evaluation of "Inadequate" in any Performance Category, the Contractor must have either: (a) failed to satisfy the criteria listed for the Performance Levels of "Superior", "Good", "Standard", and "Deficient" set out above and did not qualify for treatment under Section III.F below; or (b) must have demonstrated:
(1) Inadequate knowledge of the Contract Documents related to that Performance Category;

(2) Performance of the work or activity being evaluated under that Performance Category which seldom met the material Contract requirements, and such failures were not excusable as the sole fault and responsibility of one or more other parties;

(3) A seriously uncooperative attitude toward Owner’s employees, consultants, or the public in connection with that Performance Category; or

(4) Performance of his or her duties in connection with that Performance Category in a seriously unresponsive, inattentive, or dilatory manner, or only after frequent prompting by Owner’s Representative.

F. No Evaluation. This rating should only be used in those circumstances where the Contractor had no contractual responsibility, either directly or through its subcontractors, suppliers, or materialmen, for performance related to that Performance Category.

IV. OVERALL EVALUATION GUIDE

The Contractor's Overall Evaluation can be determined by placing the Overall Percentage Score calculated on the Contractor Performance Evaluation Report within the numerical ranges of the following narrative ratings in the Overall Evaluation Guide:

A. SUPERIOR (Overall Percentage Score of 90% or above)

The Contractor exceeded the Contract requirements and expectations in most or all of the areas evaluated. The Contractor was extremely or completely knowledgeable regarding Contract requirements and applicable laws and regulations. A consistently high level of cooperation, project management, and job site control appreciably contributed to an unusually good result. The Contractor is commended for excellent performance.

B. GOOD (Overall Percentage Score of 70% to 89%)

The Contractor met Contract requirements evaluated, and exceeded them in some areas. The Contractor was generally cooperative, and performed his/her work with a minimum of prompting. The results of the performance were very good.

C. STANDARD (Overall Percentage Score of 50% to 69%)

The Contractor generally satisfied the minimum requirements of the Contract as evaluated. The Contractor occasionally had to be prompted or reminded of Contract requirements, but overall management of the Project was good, producing a good result.

D. DEFICIENT (Overall Percentage Score of 30% to 49%)

Even though the Project may have been accepted, the Contractor's performance as evaluated was marginal overall. While the Contractor
performed some tasks satisfactorily, most elements evaluated reflected a less than satisfactory response to Contract requirements.

E. **INADEQUATE** (Overall Percentage Score of 29% or below)

The Contractor's performance as evaluated did not meet minimum Contract requirements, or so otherwise detracted from the Project as to seriously call it into jeopardy. While the Project may have been accepted by the Owner, the effort expended by the Owner's Representative in prompting the Contractor to perform was excessive. The Contractor's poor or uncooperative performance created serious unnecessary or avoidable difficulties in achieving contract completion.

A Contractor's Overall Evaluation, being based upon an averaged rate on a discrete number of Performance Categories, should not be read or interpreted as a measure of whether the Contractor did or did not breach the contract in question.

V. **PERFORMANCE EVALUATION REPORTS**

Each Contractor Performance Evaluation Report shall be prepared by, or at the direction of, the Owner's Representative who will include numerical ratings substantiated, when necessary, by one or more narratives which describe the Contractor's performance.

Every Contractor Performance Evaluation Report containing Performance Level evaluations of "Deficient" or "Inadequate", and all Overall Evaluations on projects the total cost of which is $500,000 or more, shall contain one or more narratives which provide details substantiating the evaluations. Narratives may be provided for other Performance Categories as the evaluator deems necessary.

Narratives provided with a Contractor Performance Evaluation Report shall be based upon documentation prepared during the life of the project, e.g., project diaries, inspectors' reports, and other pertinent documents. Such documentation shall constitute a major portion of the administrative record to be used for any review, appeal, or litigation that may arise from the evaluation process.

Every Contractor Performance Evaluation Report shall be signed by the Owner's Representative and the supervisor of the Owner's Representative before a copy of the Report shall be transmitted to the Contractor. The Report shall not be considered final until such time as the review/appeal periods described in Section VI herein have been completed.

Generally, only one Contractor Performance Evaluation Report shall be issued, following completion of the contract Work. However, in addition to a final Report, one or more interim Reports may be issued at the discretion of the Owner when:

- A contract is of long duration, particularly those in excess of one year.
- An individual charged with primary responsibility for administration of the Contract will cease his or her involvement with the Project prior to completion of the Work.
- Contractor's performance at 50% completion is deficient or inadequate.
Interim Contractor Performance Evaluation Reports shall be considered to be preliminary and shall be designated as such, and shall be processed administratively in the same manner as a Final Report. A Contractor may request review of an Interim Report by the applicable project Director in Capital Planning and Development; and appeal to the Owner’s Associate Vice President for Capital Planning and Development or his/her designee pursuant to the provisions of Section VI below. All Interim Reports shall be attached to, and considered when preparing, the Final Report.

If a Contractor Performance Evaluation Report is an Interim Report, the Report should indicate on its face that it is Interim, and shall contain the following language:

This Performance Evaluation Report is not the final report on this Contractor on this Project. The Contractor may dispute the Report or any part thereof, and need not seek review or appeal until completion and acceptance of the Project.

VI. NOTICE, REVIEW, AND APPEAL

A. Notice. Contractors shall be mailed a copy of their Contractor Performance Evaluation Report within a reasonable time after completion of the Report. A Contractor who is given an Overall Evaluation of "Deficient" or "Inadequate" in connection with a project shall be provided with a copy of the Contractor Performance Evaluation Report via certified mail (return receipt requested).

B. Review. A Contractor who disputes, or is otherwise dissatisfied with, his or her Contractor Performance Evaluation Report may request review of the Report by the applicable project Director in Capital Planning and Development. The request must be submitted in writing within thirty (30) calendar days of receipt by the Contractor of the Final Contractor Performance Evaluation Report. The request must also state, with specificity, all bases for the requested review.

The applicable project Director shall, upon receipt of a proper and timely request, review the Contractor Performance Evaluation Report and any documentation submitted by the Contractor with his or her request. The applicable project Director shall, on the basis of his or her review, issue findings which may affirm, correct, or modify all or any part of the Report. A copy of the findings shall be mailed to the Contractor via certified mail, return receipt requested.

C. Appeal. Within ten (10) calendar days of receipt by the Contractor of the applicable project Director’s findings on review, the Contractor may appeal therefrom to the Owner’s Associate Vice President for Capital Planning and Development or his/her designee. Any such appeal shall be in writing, and shall state with specificity the bases or grounds for the appeal.

The Associate Vice President for Capital Planning and Development or his/her designee shall review and consider the objectivity, accuracy, completeness, and fairness of the Contractor Performance Evaluation Report, together with the applicable project Director’s findings, engineers’ diaries, job records and other documentation, including such documentation as the Contractor may provide with the appeal.

Upon hearing and review of the applicable Director’s findings, the Associate Vice President for Capital Planning and Development or his/her designee shall issue a determination and findings which may affirm or modify the Contractor's Contractor Performance Evaluation Report. The
VII. **NOT RESPONSIBLE DETERMINATION FOR WORK ON SPECIFIC PROJECT**

The Owner's Associate Vice President for Capital Planning and Development may determine, from Contractor Performance Evaluation Reports and other public documents relating to the project in question, that a Contractor who has received one or more Overall Evaluations of "Deficient" or "Inadequate" is not a responsible bidder and not able to successfully perform a specific project of the Owner for which the Contractor submitted a bid, and is therefore ineligible for award of that contract.

When, on that basis, the Owner's Associate Vice President for Capital Planning and Development believes that the low bidder is not a responsible bidder and not able to successfully perform a project, the Owner shall notify the low bidder in writing of its determination that the bidder is not a responsible bidder. The bidder may appeal the determination within the time period specified in the Instructions to Bidders by presenting additional information to the Owner. The Owner shall consider the additional information before issuing its final determination. In evaluating the additional information, the Owner may or may not meet with the bidder to hear additional information. If the final determination affirms that the bidder is not responsible, the Owner will not execute a contract with any other bidder until two business days after the bidder determined to be not responsible has received the final determination.

VIII. **DEBARMENT OF CONTRACTOR**

The Owner's Associate Vice President for Capital Planning and Development or his/her designee, after conducting a hearing with the Contractor and evaluating the evidence, may debar a Contractor from contracting with the Owner for a period of up to two years if a Contractor has received overall evaluations of their performance of "Deficient" or "Inadequate" on three or more projects of the Owner physically completed during the preceding five (5) year period.

IX. **RELEASE OF INFORMATION**

Contractor Performance Evaluation Reports are public documents subject to disclosure to other governments and to the public. Because the Reports and the Overall Evaluations they contain may be used as a basis for contract award and may reflect upon the Contractor's reputation, care must be taken to assure that only accurate, complete, and current information is released.

A. **Final Reports.** Contractor Performance Evaluation Reports may be released when:

1. The Report becomes final as set forth in Section V herein; or
2. The Owner has relied upon the Report for the purpose of taking further action with respect to the Contractor; or
3. A court has ordered release of the Report.

B. **Interim Reports.** Interim Contractor Performance Evaluation Reports may only be released when:

1. The Contractor has consented in writing to the release; or
(2) The Contractor has requested and received final administrative review of an Interim Report; or

(3) The Owner has used or relied upon the Interim Report to take action with respect to the Contractor; or

(4) A court has ordered release of the Report.

C. Termination for Cause and Pending Litigation. In the event that the Contract is terminated by Owner for cause, this fact shall be noted on the Contractor's Contractor Performance Evaluation Report. In the event that a Contractor commences suit against the Owner, that Contractor's Performance Evaluation Report shall not be released without approval from the Washington State Attorney General's Office.

D. Intergovernmental Cooperation. All requests for Contractor references from agencies of foreign, federal, state, or local governments shall be referred to the Owner's applicable project Director or his/her designee. If such a request is honored, the requesting agency shall be provided with copies of all Contractor Performance Evaluation Reports on the Contractor, together with any written objections or refutations filed with the Owner by the Contractor in connection therewith.

X. INSTRUCTIONS FOR COMPLETING EVALUATION FORMS

The Owner's Representative shall complete Sections I (Contractor Data) and II (Project Data), and then evaluate the Contractor's performance in each of the Performance Categories listed in Section III (Performance Data) of the Contractor Performance Evaluation Report, and shall assign points for each category based on the Performance Level applicable for the Contractor's performance.

The descriptions provided on the Contractor Performance Evaluation Report form for each Performance Category will not necessarily match precisely with the Contractor's actual performance of the task(s) on a given portion of the project.

The Owner's Representative should consider the general character of the Contractor's performance for each Performance Category evaluated and select the Performance Level that most closely matches the actual performance.

If the Contractor was not responsible for any performance in connection with a given Performance Category, then the Contractor's evaluation in that Category should be "No Evaluation," and no points should be assigned.

When rating a Contractor, the Owner's Representative should consider all the work performed by the Contractor as well as work performed by all subcontractors, since the Contractor is contractually responsible to the Owner for all of the work under the Contract, whether or not the Contractor actually performs the work. Interim Reports, if issued, shall be attached to the Final Report.

Comments are always encouraged, and may be written on the Contractor Performance Evaluation Report or on an attachment to the Report.

However, for each Performance Category evaluated as "Deficient" or "Inadequate", the Owner’s Representative must prepare a written narrative substantiating the facts and circumstances giving rise to the evaluation.
After evaluating the Contractor on Performance Categories listed in Section III of the Contractor Performance Evaluation Report, the Owner’s Representative shall total all of the points assigned and divide that into the total points possible (excluding those Performance Categories evaluated as "No Evaluation"). The evaluator will enter the resulting Overall Percentage Score on the Report, and will enter the appropriate Overall Evaluation on the basis of the following ranges:

- **Superior**: Overall percentage score of 90% or above
- **Good**: Overall percentage score of 70% to 89%
- **Standard**: Overall percentage score of 50% to 69%
- **Deficient**: Overall percentage score of 30% to 49%
- **Inadequate**: Overall percentage score of 29% or below

The Owner’s Representative shall sign the Report and forward it to his or her supervisor for concurrence signature and submission to the Owner’s Contracts Department. The Contracts Department staff shall then forward signed copies of the completed Report to the Contractor.

END OF SECTION 00 73 20
APPENDIX A

Division 00 and 01 Forms

00 21 13 Instructions to Bidders
  ♦ Public Works Contract

00 72 10 Contractor Performance Evaluation Program
  ♦ Contractor Performance Evaluation

01 25 00 Substitution Procedures
  ♦ Substitution Request Form

01 26 00 Contract Modification Procedures
  ♦ Change Order Proposal
  ♦ Change Order Transmittal
  ♦ COP General Contractor Breakdown Summary – (for contracts less than $3 million)
  ♦ COP Subcontractor Breakdown Summary – (for contracts less than $3 million)
  ♦ COP Cost Breakdown
  ♦ COP Wage Rates
  ♦ COP Equipment Rates

01 29 76 Applications for Payment
  ♦ Application and Certificate for Payment on Contract
  ♦ Invoice Voucher – Construction
  ♦ Invoice Voucher – Retainage
  ♦ Monthly Subcontractors List and Certifications
  ♦ Statement of Intent to Pay Prevailing Wages and Affidavit of Wages Paid Information
  ♦ Certificate of Payment of Labor and Materials
    (This Certificate is a closeout form that is due after the Final Acceptance date.)

01 31 00 Project Management and Coordination
  ♦ RFI – Request for Information
  ♦ Non-Conformance Report

01 32 16 Construction Project Schedule
  ♦ Short Interval Schedule

01 35 23 Owner Safety Requirements
  ♦ Contractor Declaration and Reporting Form – Chemicals of Interest

01 45 00 Contractor Quality Control (CQC)
  ♦ Contractor Quality Control Daily Report

01 50 00 Temporary Facilities and Controls
  ♦ Utility Shutdown Request
APPENDIX B

Prevailing Wage Rates Information
Washington State Department of Labor and Industries

The applicable effective prevailing wage rates for this Project are determined by (a) the bid submittal date, and (b) the county where the Project is located.

The applicable effective date for prevailing wage rates for this Project is the date of bid submittal specified in Section 00 11 00, or as modified by any subsequent addenda.

The County where this Project is located is: King

Current prevailing wage rate information, including the applicable Benefit Code Key, may be obtained through the following sources:


Hard Copies may be obtained upon request from the University of Washington Capital Planning & Development at:

Cindy Magruder, Project Integrator Manager
Project Delivery Group
University of Washington
University Facilities Building
Box 352205
Seattle, WA 98195-2205

Email: magruder@uw.edu

In Person: In addition, current prevailing wage information is available for viewing at the location noted above.
APPENDIX C

Regulated Materials Survey

Good Faith Survey Report Hazardous Materials Summary of Findings
University of Washington Medical Center – Surgery Pavilion
UWMC IT EDS Office Space
UW 207229
PART 1 - GENERAL

1.1 PROJECT DESCRIPTION

A. The Work of the Contract Documents can be summarized as follows:

The project includes the following work: Interior renovation of the former Data Center in the UW Surgery Pavilion, first floor. Selective demolition of existing partitions, New partitions and drywall; New suspended acoustical ceiling; New and relocated hollow metal and wood doors, new hardware; New Nora tile flooring, New resilient base; Prep and paint all new and existing walls; New lighting, Add convenience power for office and pharmacy refrigerators; Rough in for Owner furnished data connections; Modification of existing HVAC system and controls; Modification of existing fire sprinkler system. This is unoccupied space and is on a non-patient care floor. 2,333 square feet.

1.2 GENERAL INFORMATION

A. Title of Contract Documents:
1. University of Washington
   UWMC IT EDS OFFICE SPACE
   Project Number: 207229

B. Owner and A/E Defined:

1. Owner:
   University of Washington
   Project Delivery Group
   Seattle, Washington 98195-2205

   Project Manager: Beck Eatch
   E-mail: beatch@uw.edu
   Phone: 360 621 4527

   Owner’s Representative: The Owner shall designate, in writing, the Owner’s Representative for this Project during construction.

2. A/E:
   Buffalo Design
   1520 4th Avenue
   Suite 400
   Seattle, WA 98101

   Representative: Louise Wackerman
   E-mail: Louise@buffalodesign.com
   Phone: 206.467.6306

3. The Owner, the A/E, and various consultants hereinafter or otherwise listed shall be given access to the Work insofar as their interests are concerned.

C. A/E’s Sub-Consultants: The sub-consultants under contract with the A/E in preparation of the Contract Documents are:
D. Owner’s Consultants: The consultants under contract with the Owner in preparation of the Contract Documents are:

1. Hazardous Materials Remediation
   PBS Engineering & Environmental
   214 E Galer Street
   Suite 300
   Seattle, WA 98102

   Representative: Willem Mager
   E-mail: Willem.Mager@pbsusa.com
   Phone: 206.766.7622

1.3 SPECIAL CONDITIONS

A. Description of special conditions of the Work:

1. Parking: Parking at the UW Medical Center is limited. Refer to Section 01 50 00 – Temporary Facilities and Controls for more information regarding parking availability.

2. Noise Restrictions: adjacent spaces in the building will be occupied throughout construction. Refer to Section 01 50 00 - Temporary Facilities and Controls regarding noise control and working hours.

3. Infection Control: Infection control measures will be implemented throughout construction. Refer to Section 01 35 33 – Infection Control.

4. Loading/Unloading: All deliveries to the site should be scheduled in advance with the Owner’s representative. The only available loading dock is AA Dock with scheduled delivery times between 7 AM and 2 PM. After 2 PM, all deliveries to the AA Dock will be on a first come, first served basis.

5. Contractor will be required to coordinate shutdown activities with Owner and participate in a weekly coordination meeting that will include all Contractors and vendors invited by the Owner.
PART 1 - GENERAL

1.1 DESCRIPTION

A. Regulated materials requiring special handling or abatement or protection during construction include hazardous materials and dangerous wastes. The Owner has investigated the Project Site and determined that the following regulated materials could be encountered during construction and may be impacted by the Work:
1. Mercury-containing fluorescent light tubes
2. Silica containing materials
3. This Biological Procedures – SARS-CoV-2/Covid-19

B. Section and the following related Construction Documents were prepared by the Owner’s environmental consultant:
1. Section 02 80 00 “Facility Remediation”
2. Appendix C - Environmental Assessment Report and or the Regulated Materials Survey Report

C. Owner’s Environmental Consultant: The Owner’s environmental consultant and the AHERA-certified designer for this Project is:
   Firm Name: PBS Engineering and Environmental Inc
   Project Designer: Willem Mager
   Certification number: PDR – 21 – 0536B
   Expiration date: 04/02/2022

D. Survey: The Owner has included in Appendix C of the Specifications a Regulated Materials “Good Faith” Survey report of the Project site area to be impacted by the Work. The Contractor shall ensure that a copy of this report is provided to all bidders and Subcontractors. A copy of this Survey must be retained and available for review on the Project site at all times throughout the duration of the Project.

E. The Owner has hired an environmental consultant to investigate the project site for environmental contamination where the site is suspected or known to contain underground storage tanks, contaminated soil, contaminated groundwater, and methane gas. A sub-surface environmental site assessment report is found in Appendix C. The Contractor shall ensure that a copy of this report is provided to all bidders and Subcontractors. If the work will occur in the area of the Montlake Landfill or within 1000 feet of the Montlake Landfill, the bidders and all Subcontractors shall also have a copy of the Montlake Landfill Project Guide.

1.2 GENERAL REQUIREMENTS

A. Laws, Regulations, Codes and Ordinances: The Contractor shall comply with all applicable laws, regulations, codes, and ordinances concerning the impact, removal, handling, storage, disposal, monitoring and employee protection against exposure or environmental protection against pollution, related to regulated materials requiring special handling or abatement or protection during construction.

B. Supervisory Authority: The Contractor is solely and completely responsible related to the Contractor’s supervisory authority over Subcontractors and personnel performing work of this Section.
C. Asbestos Awareness Training: The Contractor shall provide asbestos awareness training for its onsite employees and the onsite employees of the Contractor's Subcontractors (of any tier), in accordance with WAC 296-62-07722(6).

D. Access Restrictions: Access to various construction work areas by the general public, Subcontractors, and other individuals is restricted during certain hazardous materials work sequences, as specified in the Contract Documents. The Contractor shall coordinate the Work to facilitate access by Subcontractors while enforcing work area restrictions, and shall minimize disruption to building occupants and services.

E. Hazwoper Training: The Contractor shall provide the appropriate level of HAZWOPER training for its onsite employees and the onsite employees of the Subcontractors (of any Tier) when working on a federal or state-listed contaminated site in accordance with WAC 296-843-100.

F. Working Hours: No hazardous materials work shall occur when building users have access to work areas. All hazardous materials work shall be scheduled to occur in accordance with schedule requirements outlined elsewhere in the Contract Documents, and when work areas have been vacated by building users.

G. Emergency Contacts: Designated qualified representatives of the Contractor and specific hazardous materials Subcontractors are to be available on a 24-hour emergency basis for the duration of the Work. Contact information shall be provided to the Owner's Representative for inclusion in the Project emergency contact list.

H. Submittals: Contractor shall review the scope of work requirements outlined in the Contract Documents and shall submit, and require all Subcontractors performing the work of handling or disposing of any regulated materials to submit, pertinent information required by the Contract Documents.

I. Regulated, Hazardous, and Dangerous Waste Disposal:
   1. The Owner's Environmental Consultant will conduct all testing required to designate the waste streams. The Contractor shall not remove any suspect wastes from the site until the test data has been reviewed by the UW EHS, Environmental Programs and they have made a determination on the waste designation.
   2. Transportation and disposal of all hazardous materials and dangerous wastes will be managed by, and the costs will be borne by, the Owner through the Owner's Environmental Programs Office. The Contractor shall be responsible for packaging and staging hazardous materials and dangerous wastes onsite, and for scheduling pickup through the Owner's Representative.
   3. Transportation and disposal of PCB-containing ballasts (2 parts per million or greater) and TSCA-Regulated PCB Waste (50 parts per million or greater) will be managed by, and the costs will be borne by, the Owner through the Owner's UW EH&S Environmental Programs. The Contractor shall be responsible for packaging (in Owner-provided containers) and staging TSCA-Regulated wastes onsite, and for scheduling drop-off of containers and pick up through the Owner's Representative.
   4. All other regulated waste materials (including asbestos-containing materials) must be disposed of by the Contractor at an Owner audited and approved disposal facility. Approved facilities can be viewed online at http://www.ehs.washington.edu/epowaste/disposalfaclist.pdf.
      a. Lead-containing materials and materials with lead-containing coatings, which are not designated as hazardous or dangerous waste, must be handled and disposed of as a regulated waste and cannot be recycled.
         1) Exception for metal items which contain lead: Metal items which contain lead (e.g., lead flashings, vent caps, lead painted metal) may be recycled at a scrap
facility which is permitted to accept and process such materials.

2) Building materials coated with lead-containing paints (including concrete) shall not be recycled.

3) Brick and mortar waste streams that do not designate as a dangerous or hazardous waste may be recycled at a facility which is permitted to accept and process such materials.

J. Regulated Materials - Waste Manifests: Prior to Final Completion, the Contractor shall submit to the Owner copies of all transportation and disposal manifests, including signed landfill receipts and chain-of-custody, for all regulated wastes disposed of by the Contractor during the course of the Project.

1.3 SPECIAL CONDITIONS

A. The following are special conditions which will impact the Work performed under this and related Project Specifications:

1. All construction operations must comply with the most current COVID-19 mitigation related rules, mandates and guidance from the Governor’s Office including the “Stay Home, Stay Healthy” addendum, dated April 24, 2020, and additional guidance issued April 29, 2020 (and amendments). All activities must also comply with all related and applicable COVID-19 mitigation requirements issued by the Washington State Department of Labor and Industries and Public Health Agencies having jurisdiction (and associated amendments).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements of “Allowances”.

1.2 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in the same manner as for other portions of the Work.

D. Submit daily timesheets for the hours used in fulfillment of each allowance.

E. Submit purchase orders, invoices, and timesheets in the form specified for Change Orders for each allowance.

1.3 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.4 ALLOWANCES

A. Use the allowance only as directed by Owner’s Representative for purposes as described in the allowance schedule.

B. Contractor’s and subcontractor’s overhead, profit, bonds, insurance, and related costs for each allowance shall be included in the Base Bid amount and shall not be part of the allowance.

C. Allowances include only the direct material, labor, and supervisions costs.

D. At project closeout, credit unused amounts remaining in the allowance to Owner by Change Order.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damages or defects. Return damaged or defective products to manufacturer for replacement.
3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Include $34,000 in the Total Base Bid amount for infection control measures as specified in Section 01 35 33, “Infection Control”.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor’s selection for products for use in the Work, and administrative procedures for handling requests for substitutions made before and after receipt of bid.

B. Owner’s forms referenced in this Section include (see Appendix A):
   1. Substitution Request Form

1.2 DEFINITIONS

A. Definitions used in this Section are not intended to negate the meaning of other terms used in the Contract Documents.
   1. “Products” are items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the Project or taken from previously purchased stock.
   2. “Named Products” are products identified by use of the manufacturer’s name for a product, including such items as a make or model designation, as recorded in the most recent published product literature as of the date of the Contract Documents.
   3. “Materials” are products that must be cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
   4. “Equipment” is a product with operational parts, whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

1.3 QUALITY ASSURANCE

A. Source Limitations: Provide products of same kind, to fullest extent possible, from a single source.

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use (on the Project) the product selected shall be compatible with products previously selected, even if previously selected products were also options.

C. Nameplates: Except for labels required by Authorities Having Jurisdiction (AHJ), do not attach or imprint manufacturer’s or producer’s nameplates, trademarks or operating data on surfaces exposed to view in occupied spaces or on the building exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or where required by AHJ for observation after installation, on an accessible surface that is not conspicuous.

1.4 PRODUCT SELECTION

A. General Product Requirements: Unless otherwise indicated, provide products that comply with the Contract Documents and that are undamaged and unused at the time of installation.
   1. Provide products complete with all accessories, trim, finish, safety guards and other devices and with details needed for a complete installation for the intended use and effect.
   2. Where available, provide standard products of a type and manufacturer used successfully in similar situations on other projects.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations. Procedures governing product selection include the following:
1. Performance Specifications: Performance specifications may be one of the following:
   a. One or more named reference(s) with no accompanying conditioning language such as “or approved equal” or “no substitutions”; or
   b. No named reference is specified, and requirements are specified by means of any of the following:
      1) Descriptive requirements
      2) Design requirements
      3) Performance requirements
      4) Regulatory requirements and/or industry standards
2. References to equipment, material, articles or patented processes by trade name, manufacturer, make or catalog number, are presumed to set a standard of quality so as to encourage competition. The term “equal” is presumed and need not be repeated in the Specifications. Where Specifications set a standard of quality, provide product options complying with or exceeding the provisions of the Contract Documents, and which are recommended by a manufacturer for the applications indicated. No Substitution Request is required. However, Owner may request, and Contractor shall provide, documentation of the manufacturer’s recommendations for a particular product application.
3. Closed Proprietary Specifications: Products by one or more manufacturers are specified, and the specification section includes the term “no substitution(s),” “no other(s),” or “no exceptions.” No other product options will be accepted. Provide products and work as specified.
4. Open Proprietary Specifications: Products by one or more manufacturers are specified, and the specification section includes the term “or approved equal,” or “other acceptable.” Submit the Substitution Request Form for other products to Owner under the provisions of this Section.
5. Visual Matching: Where matching an established sample is required, the Owner’s decision will be final on whether a proposed product matches satisfactorily.
   a. Where there is no product available within the specified product category which matches satisfactorily and also complies with other specified requirements, the contractor shall comply with the provisions of the Contract Documents concerning substitutions for the selection of a matching product in another product category.
6. Visual Selection: Where specified product requirements include the phrase “...as selected from the manufacturer’s standard colors, patterns, textures...” or similar phrases, select a product and manufacturer that complies with other specified requirements. Owner will select the color, patterns and texture from the product line selected.

1.5 PRODUCT SUBSTITUTION

A. General:
   1. No substitution request will be considered unless submitted in accordance with the requirements of this Section.
   2. If a bidder or Contractor desires approval of some material or product other than that specified by the Contract Documents, it must submit a written request for approval of the proposed substitute item to the Owner in accordance with the following requirements:
      a. All requests must be made on the Owner’s Substitution Request Form
      b. After receipt of bid, substitution requests shall be prepared, transmitted, and processed in accordance with Section 01 33 00 “Submittal Procedures.”
   3. Final decision as to whether an item is an equal or acceptable substitution rests solely with the Owner.

B. Substitution Requests: Every substitution request must state whether the item offered is equal or superior to the specified product. The substitute material or product must be accompanied by its reference in the Contract Documents and complete catalog, technical and other information. If applicable, include samples showing comparison of physical and other pertinent characteristics as required to establish equivalence of acceptability for the proposed
application. Where specific test results are required by the Contract Documents, the comparison data for the proposed item shall be based upon the same test methods as those specified, or they shall be correlated to clearly demonstrate comparability. The same warranty of the Work described for the specified product is required for the substitution.

C. During Bid Period:
1. Submit Substitution Request Form prior to the date identified in Section 00 21 00 “Instructions to Bidders.”
2. Bidders will be notified by addendum of products accepted in addition to those specified. NO OTHER FORM OF APPROVAL, INCLUDING VERBAL OR IMPLIED, IS ACCEPTABLE AS AN INDICATOR OF ACCEPTED SUBSTITUTION REQUESTS.

D. After Receipt of Bid: Contractor shall indicate one or more reasons why a product substitution is required with a Substitution Request Form. Owner will notify Contractor in writing of decision to accept or reject the Substitution Request. Substitution Requests will not be considered except for the following reasons, which must be substantiated by the Contractor:
1. Unavailability: Specified item has been discontinued or is unavailable in time to meet Construction Schedule through no fault of the Contractor or Subcontractor.
2. Unsuitability: Subsequent information discloses the specified item as unsuitable, inappropriate, or unable to perform properly or fit the designated space.
3. Regulatory Requirements: A substitution is required to comply with code interpretations by AHJ or insurance regulations.
4. Warranty: A manufacturer or fabricator declares the specified item to be unsuitable for the use intended or refuses to certify or warrant the performance of the specified item for the Project.
5. Owner's Benefit: In the judgment of Contractor, acceptance of the proposed substitution is clearly in Owner's best interest because of cost, quality, or other consideration.

E. Coordination: In making a Substitution Request, the Contractor certifies that it will coordinate all Subcontractor work required by the substitution and waives all claims for additional costs and/or time which subsequently become apparent as a consequence of the substitution.

F. Re-design: At the Owner's sole discretion, the Contractor shall bear all Owner costs related to the substitution, including costs of A/E's services for investigation, evaluation and re-design, if necessary.

G. Owner will not consider:
1. Substitutions, if they are indicated or implied on Shop Drawings or other Project data submittals;
2. Substitutions which, if accepted, will require substantial revisions of Contract Documents; or
3. Substitution Request Forms which do not provide adequate or clearly defined information for complete and timely appraisal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the administrative and procedural requirements for executing a change in the Work as herein specified and further described in Part 7 of the General Conditions.

B. Owner’s forms references in this Section include (see Appendix A):
   1. Change Order Proposal;
   2. Change Order Transmittal;
   3. COP General Contractor Breakdown Summary;
   4. COP Subcontractor Breakdown Summary;
   5. COP Cost Breakdown;
   6. COP Wage Rates; and
   7. COP Equipment Rates.

1.2 PRELIMINARY REQUIREMENTS:

A. Prior to submitting the Contractor’s first Change Order Request (COR), or responding to the first Change Order Proposal (COP), the Contractor shall submit a breakdown of journeyman and apprentice, where applicable, wage rates using the Owner’s COP Wage Rates form. The breakdown shall show:
   1. Basic wage rate (based on L&I Intent to Pay Prevailing Wages or union agreement);
   2. Fringe Package (based on L&I Intent to Pay Prevailing Wages or union agreement);
   3. FUI (Federal Unemployment Insurance);
   4. FICA (Federal Insurance Compensation Act);
   5. Medicare;
   6. SUI (State Unemployment Compensation Act);
   7. WC (Workers Compensation).

B. Contractor shall submit verification of the above rates, if requested by Owner’s Representative.

C. Prior to submitting Contractor’s first COR or responding to Owner’s first COP that involves equipment owned by the Contractor, the Contractor shall submit a list of all equipment anticipated to be used on the Project. Contractor shall provide the hourly rate based on the Equipment Watch Rental Rate Blue Book and as modified by the current AGC/WSDOT Agreement or other sources as referenced in the General Conditions. The Contractor shall use the Owner’s COP Equipment Rates form to compute the equipment rate.

1.3 CHANGE ORDER PROCEDURES

A. Owner Change Order Proposal (COP): Changes may be initiated by Owner through a Publics Work Change Order Proposal form submitted to the Contractor. Such a request is for information and pricing only and is not an instruction to execute changes or to stop work in progress, unless issued as a Field Order.
   1. The COP will include:
      a. A detailed description of changes, products, and location of modification in Project and a statement as to whether overtime work is authorized; and
      b. Supplementary or revised Drawings or Specifications.
   2. An updated Construction Progress Schedule may be requested if the COP impacts the existing Construction Progress Schedule.
B. Contractor Change Order Request (COR): The Contractor shall initiate changes by submitting written correspondence, in letter format, signed and dated to the Owner's Representative requesting a Change Order Proposal. The letter shall include:
   1. Description of proposed changes;
   2. Reason for making changes;
   3. A specific period of time during which requested price will be considered valid;
   4. Actions required by Owner;
   5. Effect on Contract Sum and Contract Time;
   6. Documentation consistent with the requirements of Part 7.02 and/or 7.03 of the General Conditions supporting any change in Contract Sum or Contract Time, as appropriate;
   7. Statement of why proposed change is not covered in Contract Documents; and
   8. Date the Work is to be completed.

C. Field Order: In situations where time is of the essence or an emergency condition exists, the Owner's Representative may directly order a change to the Work by a written Field Order signed by Owner's Representative. Field Orders will only be issued on an agreed upon not-to-exceed cost basis, either lump sum or time and materials.

D. Change Order Pricing:
   1. The cost of the change shall be marked-up in accordance with General Conditions and Modifications to the General Conditions. NO ADDITIONAL MARK-UPS SHALL BE ALLOWED.
   2. Contractor shall provide all backup pricing documentation for a change on the following forms (THESE FORMS SHALL ALSO BE THE ONLY ACCEPTABLE DOCUMENTATION FOR ALL SUBCONTRACTORS.):
      a. COP General Contractor Breakdown Summary
      b. COP Subcontractor Breakdown Summary
      c. COP Cost Breakdown
   3. Owner’s Representative may require Contractor to provide certified payroll.
   4. Provide all other supporting documentation as required to substantiate the requested costs such as invoices for rental equipment and freight cost. Total cost and time shall be brought forward to the COP form and signed and dated by Contractor.

E. Change Order Authorization:
   1. A/E recommendation of COP acceptance to Owner is indicated by A/E's signature.
   2. Upon signature and execution by Owner, the Change Order Proposal becomes a Change Order altering the Contract Sum and/or Contract Time, as indicated.
   3. Contractor may only request payment for changes in the Work against an approved Change Order.
   4. If Owner disapproves the Change Order Proposal, the reason for disapproval will be stated. A request for a revised proposal or cancellation of the proposal will be shown and returned to the Contractor.

F. Correlation with Contractor's Submittals:
   1. Application of Payment forms shall record each Change Order as a separate item of work (see Section 01 29 76, “Progress Payment Procedures”).
   2. Revise Construction Progress Schedule to reflect changes in Contract Time.
   3. Upon completion of Change Order work, record pertinent modifications in the Project Record documents.

G. Distribution:
   1. Upon authorization of a Change Order, Owner will transmit one (1) signed copy to Contractor.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the administrative and procedural requirements for Contractor progress payment and release of retainage as herein specified and further described in Part 6 of the General Conditions.

B. Owner’s forms referenced in this Section include (see Appendix A):
   1. Application and Certificate for Payment on Contract (Application for Payment)
   2. Construction Invoice Voucher
   3. Retainage Invoice Voucher
   4. Monthly Subcontractors List and Certifications
   5. Certificate of Payment of Labor and Materials

1.2 PREREQUISITES FOR FIRST APPLICATION FOR PAYMENT

A. Progress Schedule: Submit and receive approval of the “preliminary” Progress Schedule.

B. Prevailing Wage Forms: Submit Statement of Intent to Pay Prevailing Wages form, approved by the Department of Labor and Industries, prior to commencing the Work (see Part 5.04B of the General Conditions). The Owner will not make payment on an Application for Payment until the Contractor has filed with the Owner an approved copy of the form for the Contractor and every Subcontractor of every tier that performed work during the payment period and are included in an Application for Payment. The form shall list every classification of laborer, worker, or mechanic employed by the Contractor and its Subcontractors. THERE ARE NO EXCEPTIONS TO THIS REQUIREMENT.
   1. The website address link to the prevailing wage forms is included in Appendix A.
   2. The website address link to the “Washington State Prevailing Wage Rates for Public Works Contracts” is included in Appendix B.

C. Schedule of Values: Before submitting the first Application for Payment, submit and receive approval of the Schedule of Values allocating the detail of the Contract Award Amount, in a breakdown acceptable to the Owner, which shall be documented on the Application for Payment. The approved Schedule of Values will be used by the Owner as the basis for progress payments. PAYMENT FOR WORK WILL ONLY BE MADE FOR, AND IN ACCORDANCE WITH, THOSE ITEMS INCLUDED IN THE APPROVED SCHEDULE OF VALUES.
   1. Format: On 8-1/2" x 11" paper
   2. Content: Include as a minimum the following:
      a. Individual Items of Work.
      b. Major cost items, which are not directly a cost of actual work-in-place, shall be shown as separate items in the Schedule of Values, and shall include the following items:
         1) General Conditions, mobilization, and distinct temporary facilities shall not exceed 3% of the Contract Award Amount.
         2) Section 01 77 00 “Closeout Procedures” shall not be less than 4% of the Contract Award Amount.
         3) Preparation and submittal to Owner of Construction Baseline Schedule and Submittal Schedule shall not be less than 1/4% of the Contract Award Amount.
4) Preparation of monthly Progress Schedule updates shall not be less than 1/4% of the Contract Award Amount, with the value of each update apportioned equally.

c. For items on which progress payments will be requested for materials or equipment purchased/fabricated/delivered, but not yet installed, show "initial value" for payment request and "value added" for subsequent stage(s) of completion on that unit of work.

d. For each line item of installed value exceeding 10% of Contract Award Amount, show breakdown by major products or operations under each item.

e. Breakdown major work efforts by floor or phases or systems as appropriate for ease of review and confirmation of Work completed.

f. Breakdown mechanical and electrical systems or phases with material and labor as separate items.

3. Round figures to nearest dollar amount.

4. Make sum of total scheduled costs equal to the Contract Award Amount. Do not include State of Washington sales tax.

5. Coordinate items of the Schedule of Values so that there is a corresponding item in the Progress Schedule.

6. Revise as requested by Owner.

D. Subcontractors List: Submit a list of all Subcontractors and major material suppliers consistent with Part 5.20B of the General Conditions.

E. Retainage: Submit instructions for the disposition of retainage funds.

1. In accordance with Part 6.04B of the General Conditions and Chapter 60.28 RCW, the Owner shall reserve a Contract retainage in an amount not-to-exceed 5% of the moneys earned by the Contractor as a trust fund for the protection and payment of:
   a. The claims of any person arising under the Contract Documents;
   b. The State of Washington with respect to taxes imposed pursuant to Titles 50, 51, and 82 RCW which may be due from the Contractor, and;
   c. The Owner for claims it may have against the Contractor.

2. Contractor's written instructions should be addressed to the University of Washington, UW Facilities, Project Delivery Group, Accounting Department, Box 352205, Seattle, Washington 98195 - 2205.

3. At the option of the Contractor, the moneys reserved by the Owner shall be:
   a. Retained in a fund by the Owner; or
   b. Bonded by the Contractor (if approved by Owner) for all of the Contract retainage in a form acceptable to the Owner; or
   c. Deposited by the Owner in an Owner's interest bearing account in a bank, mutual savings bank, or savings and loan association; or
   d. Placed in escrow with a bank or trust company by the Owner.

1) Escrow Agent: If the retained funds are to be placed in escrow, Contractor will select the escrow agent, subject to approval by the Owner. The selected agent must be a bank or trust company in the State of Washington.

2) Escrow Agreement: Pursuant to electing the escrow option, an escrow agreement shall be executed by Contractor, Owner, and bank. A completed and signed escrow agreement in a form acceptable to the Owner must be on file with the Owner for payment before the Contractor's first Application for Payment is processed.

3) Escrow Payments: As each progress estimate is presented for payment, Contractor shall make a voucher request for the retained funds that are to be placed in escrow. Such requests should be prepared on the Owner's Retainage Invoice Voucher form and submitted with the related Application for Payment. Upon receiving a retainage invoice, the Owner will issue a check payable to the
Contractor and the bank jointly. Such checks will be mailed to the bank and the Contractor will receive copies of check transmittal letters.

4) Escrow Investments: The bank shall invest the retained funds in bonds and other securities selected by the Contractor from the following list approved by the Owner:
   a) Bills, certificates, notes or bonds of the United States;
   b) Other obligations of the United States or its agencies;
   c) Obligations of any corporation wholly owned by the government of the United States;
   d) Indebtedness of the Federal National Mortgage Association;
   e) Time deposits in commercial banks, mutual savings banks, and savings and loan associations in the State of Washington;
   f) Deposits in savings accounts in commercial banks, mutual savings banks, and savings and loan associations in the State of Washington.

5) The investments selected must mature on or prior to the date set for Substantial Completion, including extensions thereof or no later than forty five (45) days following the Final Acceptance of the Work. Interest on such investments shall be paid to the Contractor by the escrow agent as it accrues.

6) Escrow Costs and Fees: All escrow costs and fees shall be paid by the Contractor, in accordance with the escrow agreement.

1.3 DRAFT APPLICATION FOR PAYMENT

A. Submit a draft Application for Payment for Owner’s review and comment. The cutoff date shall be five (5) days prior to actual application or as otherwise agreed. Include projected costs to the end of the month in the pay request. Provide the following documents (draft documents may be marked by hand):
      a. Mechanical and electrical Subcontractor's draft monthly payment requests shall be submitted, for review and comment, prior to the A/E’s and Owner’s review of the Contractor’s draft monthly Application for Payment.
      b. List Change Orders approved prior to the submission date individually (last on the form). Use Owner's Change Order designation and description (similar to an original component item of work). DO NOT BILL FOR CHANGE ORDER PROPOSALS UNTIL AN APPROVED CHANGE ORDER HAS BEEN RECEIVED FROM THE OWNER INCORPORATING THE PROPOSAL.
   3. Stored Materials: The Contractor is solely responsible for the stored materials. Requests for payment on materials stored shall be for materials properly stored on the Project site. In addition to the requirements of the General Conditions, payment for materials stored off-site shall be at the sole option of the Owner and comply with conditions stipulated by the Owner. These conditions may include, but are not limited to:
      a. Provide supplier invoice
      b. Provide insurance or a bond to cover the total loss of material and time impact to Project
   5. Monthly Safety Report

B. The A/E and/or Owner and the Contractor shall review the Project Record for completeness and accuracy.

1.4 APPLICATION FOR PAYMENT

A. The Contractor shall submit an electronic copy of the Application for Payment to the Owner after responding to the Owner’s comments to the draft application.
B. The Contractor is cautioned to carefully check all extensions, totals, and required information for accuracy before submittal.

C. Applications are to be signed by a responsible officer of the Contractor.

D. The Application for Payment shall include the following Owner forms and documents:
   1. Application and Certificate for Payment on Contract
   2. Construction Invoice Voucher (for the total amount due)
   3. Retainage Invoice Voucher (for the retainage amount)
   4. Monthly Subcontractors List and Certifications
   5. Invoices for materials stored off-site

E. Contractor, subcontractor, or employer shall file a copy of its certified payroll records directly with the Department of Labor and Industries online system at least once per month.

F. When the Owner’s Representative and A/E find the Application for Payment properly completed and correct, they will sign and transmit all copies of the Application for Payment to the Owner’s accounting office for processing.

G. If the A/E or Owner’s Representative find the Application for Payment improperly or incorrectly executed, an annotated copy will be returned for a new submittal.

H. Only minor corrections are allowed on the original, with approval of Owner.

1.5 PRIOR TO FINAL APPLICATION FOR PAYMENT

A. The final Application for Payment request will be accepted for processing only after providing satisfactory completion of the following:
   1. Application and Certificate for Payment on Contract
   2. Construction Invoice Voucher (for the total amount due)
   3. Retainage Invoice Voucher (for the retainage amount)
   4. Monthly Subcontractors List and Certifications
   5. Invoices for materials stored off-site
   6. Final Completion procedures per Section 01 77 00 “Closeout Procedures”
   7. Final Schedule of Values “Contract Sum”
   8. Monthly Safety Report

1.6 RELEASE OF RETAINAGE

A. Pursuant to the completion of Work performed in accordance with the Public Works Contract and Final Acceptance by the Owner, the following requirements must be satisfied prior to the release of retained Contract funds:
   1. “Notice of Completion of Public Works Contract (REV 31 0020)”: This Department of Revenue form will be completed by the Owner, establishing the date of Final Acceptance. A copy of the notice will be e-mailed to the Department of Revenue, the Employment Security Department, the Department of Labor and Industries, and a copy will be transmitted to the Contractor.
   2. “Certificate of Payment of State Excise Taxes by Public Works Contractor (REV 31 0028)”: Following receipt of the Owner’s Notice of Completion of Public Works Contract form and after determining that all taxes, interest and penalties due from Contractor have been paid, the Department of Revenue will issue this certificate to Owner, thereby notifying the Owner that it has no objection to the release of retainage to the Contractor.
   3. “Certificate of Payment of Contributions, Penalties and Interest on Public Work Contract (EMS 8449 760)”: Upon receiving a copy of the Owner’s Notice of Completion of Public Work Contract form and after determining that all taxes, interest and penalties due from Contractor have been paid, the Department of Revenue will issue this certificate to Owner, thereby notifying the Owner that it has no objection to the release of retainage to the Contractor.
Works Contract form from the Department of Revenue and determining that the Contractor is in compliance with the provisions of the Employment Security Act, the Employment Security Department will issue this certificate to Owner, thereby notifying the Owner that it has no objection to the release of retainage to the Contractor.

4. Upon receiving a copy of the Owner’s Notice of Completion of Public Works Contract form and determining that the Contractor is in compliance with the provisions of Chapter 51 RCW for payment of industrial insurance premiums, the Department of Labor and Industries will issue a certificate for the Owner, thereby notifying the Owner that it has no objection to the release of retainage to the Contractor.

5. “Affidavit of Wages Paid on Public Works Contract” (F700-007-000): An Affidavit of Wages Paid, for the Contractor, each Subcontractor, and each sub-tier Subcontractor, approved by the Industrial Statistician of the Department of Labor and Industries, must be submitted by the Contractor to the Owner. Contractors and Subcontractors may file the Affidavit of Wages Paid either on-line at the website link provided in Appendix A or by completing the forms manually.

6. “Certificate of Payment of Labor and Materials”: This Owner’s form shall be completed by the Contractor and returned to the Owner. If the only exception to full payment to all Subcontractors is retainage owed to Subcontractors, the appropriate box on the form should be checked.

7. Invoice Voucher: If the retained funds are on deposit in Owner accounts, the Contractor shall prepare a Retainage Invoice Voucher for the total amount retained and submit to the Owner for payment. If these funds have been placed in escrow at the direction of Contractor, no further invoice is required.

B. Retainage will be paid by the Owner to the Contractor sixty (60) days following the published date of Final Acceptance, contingent upon the Contractor’s compliance with provisions of public works statutes and as stated above. If there are either unpaid taxes or unsatisfied claims of lien against the retained percentage, disbursement of retainage funds will be made in accordance with State of Washington law.

C. Address all transmittal of retainage documents to the Owner’s Representative at: University of Washington, UW Facilities, Project Delivery Group, Box 352205, Seattle, Washington, 98195 - 2205.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for project management and coordination during construction, in addition to the requirements specified elsewhere in the Contract Documents.

B. Owner’s forms referenced in this Section include (see Appendix A):
   1. Request for Information (RFI)
   2. Non-Conformance Report (NCR)

C. The Owner intends to utilize an internet-based construction management system (CMS) for communications and documents controls with the Contractor and A/E on this Project (see Section 01 35 00 “Electronic Controls”).

1.2 GENERAL COMMUNICATION

A. The Owner shall designate, in writing, the Owner’s Representative for this Project.

B. All verbal communications between Owner, A/E, and Contractor shall be for clarification and collaboration purposes and are not binding unless issued in writing through the Owner’s Representative.

C. Contractor communications by and with A/E’s consultants shall be through the A/E, and A/E’s communications by and with the Contractor’s Subcontractors shall be through the Contractor.

D. In case of an emergency:
   1. Contact the Owner’s Representative; Sarah Hollenbeck 206 423 8705
   2. Follow emergency procedures in accordance with Section 01 35 23 “Owner Safety Requirements.”

1.3 CORRESPONDENCE

A. Address all correspondence to Owner’s Representative.

B. All correspondence to and from Contractor will be routed through the Owner’s Representative.

1.4 CONTRACTOR REQUEST FOR INFORMATION

A. When field conditions or Contract Documents require clarification or verification by the A/E or A/E’s consultants, a written RFI is to be submitted per the following:
   1. Identify the nature and location of each requested clarification and/or verification using the RFI form. Provide as a minimum the following information:
      a. Project name and number
      b. Date
      c. Date response required by
      d. RFI number
      e. Subject
      f. Initiator of the question
      g. Indication of costs, if known
      h. Location on site
      i. Contract Drawing reference
j. Contract Specification section and paragraph reference
k. Descriptive text

2. Number each RFI sequentially beginning with #001. Submit only one question per RFI. Also, RFI’s shall be categorized as ARCH, MECH, ELEC, etc.

1.5 CLARIFICATIONS

A. Clarifications may be discussed with A/E, or A/E’s consultants, with concurrence of Owner. Following the discussion, the Contractor shall document on an RFI form any agreed upon modification which does not require a Change Order. The A/E may provide supplemental information to clarify the Contract Documents. RFIs and A/E supplemental information (ASI) which modify or change the Work will be authorized only by Change Order.

1.6 NON-CONFORMANCE REPORT

A. Non-Conforming Work: Work found defective, or in any way not in accordance with the requirements of the Contract Documents, is defined as non-conforming Work.

B. Procedure: If, after an oral discussion or written notification, the Contractor fails to correct Work that is found defective or not in accordance with the Contract Documents, the Owner will issue a Non-Conformance Report (NCR). Upon receipt of an NCR, the Contractor shall take immediate action to resolve the Work to the Owner's satisfaction, or remove and replace with conforming Work at Contractor's expense and with no increase in Contract Time. Corrective actions for non-conforming Work shall be discussed at construction progress meetings and be completed no later than prior to Final Completion.

1. Where non-conforming Work requires re-design by the A/E, such re-design costs shall be borne by the Contractor.

1.7 COORDINATION

A. General Coordination:

1. The Contractor shall be in charge of this Contract and the Project, as well as directing and scheduling of all Work. Final responsibility for performance, interface, and completion of the Project shall be the Contractor’s.
   a. Anticipate interrelationship of all Subcontractors and their relationship with the total Work.
   b. Resolve differences or disputes between Subcontractors and materials suppliers concerning coordination, interference, or extent of the Work. Contractor’s decisions, if consistent with Contract Document requirements, shall be final.

2. Cooperation with other contractors during the term of this Project may be required within the building or other adjacent locations to the construction limits of this Project. The Contractor is to cooperate with the Owner in coordination of all work to prevent impact to this or other Owner sponsored construction projects.

3. Cooperation with building occupants may be required when scheduling construction activities that create excessive noise or structure-borne vibration. The Contractor is to cooperate with the Owner in coordination of all work to minimize these impacts to the Owner’s operations (see Section 01 50 00 “Temporary Facilities and Controls”).

B. Special Coordination:

1. The Contractor is responsible for receiving, unloading, storage and handling of Owner Furnished Contractor Installed (OFCI) items from the time of receipt through Substantial Completion.
   a. The Contractor is responsible for protecting OFCI and Owner Existing Contractor Installed (OECI) items from damage, such as: damage from exposure to the elements; or from damage to a warranty due to Contractor’s improper installation
and testing. The costs to repair or replace items damaged while in the Contractor's possession shall be borne by the Contractor.

1) The Contractor shall consult with the Owner to determine the warranty requirements of OFCI and OECI items.

C. Mechanical and Electrical Coordination:
   1. Resolve all tight or restricted conditions involving work of various sections in advance of installation.
   2. Coordinate the Work of all sections to ensure that all fixtures, devices, switches, outlets, ducts, pipes, and similar items can be installed as shown.

D. Job Site Field Measurements and Templates:
   1. Obtain field measurements required for accurate fabrication and installation of work included in the Contract Documents. Exact measurements are the Contractor's responsibility.
   2. Furnish or obtain templates, patterns, and setting instructions as required for installation of all work. Verify in field.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for meetings during construction in addition to requirements specified elsewhere in the Contract Documents.

B. Contractor and Subcontractor representatives attending meetings must be qualified and authorized to act on behalf of their firms.

C. The Owner will utilize an internet-based construction management system (CMS) for communications and documents controls with the Contractor and A/E on this Project (see Section 01 35 00 “Electronic Communications”).
   1. Meeting minutes, Contractor construction activity data and work plans, A/E field reports and other such communications shall be distributed electronically by e-mail.

D. Related Sections:
   1. Section 01 32 16 “Construction Progress Schedule”

1.2 PRECONSTRUCTION MEETING

A. The Owner will schedule a preconstruction meeting to be held prior to the Contractor mobilizing and beginning any Work. This meeting will review Contract administration requirements and mobilization procedures.

B. Meeting location: To be determined

C. Participants shall include:
   1. Contractor's Project Manager, Superintendent, CQC Representative, Safety and Health Officer, and for projects with LEED requirements, LEED Coordinator;
   2. Owner's Representative, Project Manager, and for projects with LEED requirements, the Owner’s Sustainability Manager;
   3. A/E and the A/E's sub-consultants, as appropriate;
   4. Owner’s consultants, as appropriate; and
   5. Others, including the Contractor’s major Subcontractors as appropriate.

D. Owner's Representative will: Administer the meeting

E. A/E will: Record and distribute copies of the minutes within seven (7) days of the meeting to all meeting participants.

F. Agenda:
   1. The Work including, but not limited to:
      a. Schedule and phasing requirements
      b. Contractor's use of premises
      c. Special conditions and coordination
   2. Communications including, but not limited to:
      a. Chain and persons authorized to direct changes
      b. Requests for Information (RFI), field decisions, and clarifications
      c. Non-Conformance Reports
      d. Hazard communication
      e. Project meetings
   3. Contractor's "Site Specific Safety Plan"
4. Administrative and procedural requirements including, but not limited to:
   a. Contract modification
   b. Progress payment
   c. Submittals - including Contractor’s Progress Schedule
   d. Electronic communications
5. Project LEED requirements and documentation, if any
6. Testing and inspection
7. Contractor quality control
8. Temporary facilities and controls including, but not limited to:
   a. Deliveries and storage
   b. Temporary utilities and enclosures
   c. Security procedures
   d. Noise and vibration control
   e. Cutting, patching, and field engineering
   f. Utility shutdowns
   g. Contractor parking
   h. Housekeeping and waste management
   i. Infection control - for medical facilities projects
9. Closeout procedures - including Project Record requirements
10. Other information as appropriate

G. Contractor shall conduct a like meeting, covering the same body of information, with each Subcontractor’s project manager and foreman supervising the Work prior to the performance of any work on-site by that Subcontractor.

1. Provide Owner copies of meeting minutes prepared by the Contractor with each Subcontractor, when requested by Owner.

1.3 CONSTRUCTION PROGRESS MEETINGS

A. Progress meetings shall occur as needed, but no more than weekly, until Substantial Completion has been achieved.

B. Meeting location: To be determined

C. Participants shall include:
   1. Contractor’s Project Manager, Superintendent, CQC Representative, and Safety and Health Officer as appropriate;
   2. Owner’s Representative and Project Manager;
   3. A/E and the A/E’s sub-consultants, as appropriate; and
   4. Others, including the Owner’s consultants, as appropriate.

D. Owner’s Representative will: Administer the meeting

E. Contractor shall: Provide schedules, logs and other construction activity data to support the issues discussed at the meeting.

F. A/E will: Record and distribute copies of the minutes prior to the next progress meeting to all meeting participants and provide copies at each meeting.

G. Agenda:
   1. Review and approve the minutes of the previous meeting noting exceptions, if any
   2. Review the progress of the Work since the previous meeting
   3. Review the Short Interval Schedule and work plans for progress during the period
      a. Identify pending meetings
b. Discuss safety activities and job hazards analysis
4. Discuss field observations, problems, and conflicts
   a. Identify problems impeding the construction Progress Schedule
5. Review Quality Control
   a. Non-Conformance Reports - discuss corrective Work actions
   b. Infection control – for medical center projects
6. Review the Submittal Schedule and RFIs - present methods to expedite as required
7. Review off-site fabrication and delivery schedules
8. Review proposed changes in the Work and substitution requests for:
   a. Timely processing
   b. Effect on the Progress Schedule and Substantial Completion
   c. Effect on any other contracts of the Project
9. Review any other business

1.4 PRE-INSTALLATION MEETINGS

A. Pre-installation meetings shall be held prior to the Contractor or Subcontractors beginning work on each definable feature of the Work identified in the Contract Documents to require a pre-installation meeting and/or as required by the Owner’s Representative. Notify Owner’s Representative at least ten (10) working days in advance of each pre-installation meeting.
   1. At the Owner’s discretion, the Owner may conduct this meeting as part of the Construction Progress Meeting.

B. Meeting examples include, but not by way of limitation:
   1. Site clearing and excavation
   2. Demolition and regulated materials remediation
   3. Site utilities
   4. Landscaping and site restoration
   5. Concrete
   6. Masonry
   7. Structural steel
   8. Exterior cladding systems
   9. Water and damp proofing and roofing
   10. Doors, including frames and hardware
   11. Millwork
   12. Finishes
   13. Equipment, including elevators
   14. Mechanical and Electrical systems, such as high voltage, fire alarm, and communications
   15. Specialty items

C. Meeting location: To be determined

D. Participants shall include:
   1. Contractor’s Superintendent, CQC Representative, and Safety and Health Officer as appropriate;
   2. Subcontractor’s project manager or foreman supervising the Work, as appropriate;
   3. Owner’s Representative;
   4. A/E and the A/E sub-consultants, as appropriate;
   5. Owner’s consultants as appropriate; and
   6. Others as appropriate.

E. Agenda:
   1. Review of the pre-installation CQC Work Plan and Contract requirements
   2. Materials - available and ready for use
   3. Submittals
4. Persons responsible for performing the work
5. Tests - required tests, criteria for performance, who samples and how often
6. Safety procedures and requirements
7. Substrate - criteria for substrate
8. Other items as appropriate

F. Contractor shall: Administer the meeting, and record and distribute copies of the minutes within seven (7) days of each meeting to all meeting participants.

1.5 CHANGE ORDER MEETINGS

A. Change order meetings shall be held to review and resolve any Change Order Proposals, change order requests, or other change order issues pertaining to Contract Modification. Meetings shall be held monthly until all Change Order Proposals are resolved.
1. At the Owner’s discretion, the Owner may conduct this meeting as part of the Construction Progress Meeting.

B. Meeting Location: To be determined

C. Participants shall include:
1. Contractor’s Project Manager, or cost engineer as appropriate;
2. Owner’s Representative;
3. A/E and the A/E’s sub-consultants, as appropriate;
4. Others, including the Owner’s consultants as appropriate.

D. Owner’s Representative will: Administer the meeting

E. Agenda: Review Change Order Proposals for scope and estimated costs, and negotiate Change Order Proposal prices.

1.6 DRAFT APPLICATION FOR PAYMENT REVIEW MEETINGS

A. Draft Application for Payment review meetings shall occur monthly.
1. At the Owner’s discretion, the Owner may conduct this meeting as part of the Construction Progress Meeting.

B. Meeting Location: To be determined

C. Participants shall include:
1. Contractor’s Project Manager;
2. Owner’s Representative;
3. A/E and A/E’s sub-consultants, as appropriate; and
4. Owner’s consultants as appropriate.

D. Owner’s Representative will: Administer the meeting

E. Contractor shall: Present the draft monthly Application for Payment together with the required back up information for review and comment by the Owner and A/E.

F. Agenda - Discussion will pertain to items such as:
1. Percentage of work complete
2. Off-site storage
3. Bill of quantities
4. Percentage of subcontract payment allocations
1.7 SPECIAL MEETINGS

A. Special meetings may be called at the discretion of the Owner or Contractor for the purpose of coordinating specific information or resolving special issues related to the Project.

B. Contractor shall record and distribute minutes within three (3) days of the meeting to all meeting participants.

1.8 COMMISSIONING MEETINGS DURING CONSTRUCTION

A. Commissioning meetings shall occur weekly during the start-up and commissioning phase of the Work.
   1. At the Owner’s discretion, the Owner may conduct this meeting as part of the Construction Progress Meeting.

B. Meeting location: To be determined

C. Participants shall include:
   1. Contractor’s Test Engineer, and Superintendent as appropriate;
   2. Subcontractor representative(s) as appropriate;
   3. Owner’s Representative;
   4. Owner’s Commissioning Authority; and
   5. A/E and the A/E’s sub-consultants, as appropriate.

D. Commissioning Authority will: Administer the meeting

E. Contractor shall: Record and distribute copies of the minutes prior to the next meeting to all participants and provide copies at each meeting.

F. Agenda - Discussion will pertain to items such as:
   1. Coordination of Work of applicable trades, such as balancing, electrical, controls, communications wiring connectivity;
   2. Scheduling of systems shutdown and switch over;
   3. Start-up and functional performance tests acceptance criteria; and

PART 2 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements, in addition to those defined in the General Conditions, for Baseline Progress Schedule preparation, monthly Progress Schedule updates, change in Contract Time analysis, submittal schedules, and short interval schedules.

B. Related Sections:
   1. 01 26 00, “Contract Modification Procedures”
   2. 01 29 76, “Progress Payment Procedures”
   3. 01 50 00, “Temporary Facilities and Controls”
   4. 01 77 00, “Closeout Procedures”

C. Owner’s forms included by reference for this Section include (see Appendix A):
   1. Short Interval Schedule

D. Total Float is defined as the amount of time between the earliest start date and the latest start date, or between the earliest finish date and the latest finish date of an activity on the Progress Schedule. Float is not for the exclusive use of either the Contractor or the Owner unless otherwise identified in the Contract Documents.
   1. Extensions of time for Contract performance will be granted only to the extent that equitable time adjustments to the affected activity or activities exceed the total float time along the affected paths of the current Progress Schedule at the time a Field Order, or Change Order, was issued for the change.

E. All Progress Schedule submittals, including monthly Progress Schedule updates, will be reviewed jointly by the Owner’s Representative and the Contractor. Such review of the Contractor’s schedules shall not constitute an approval or acceptance of the Contractor’s construction means, methods, or sequencing, or its ability to complete the Work in a timely manner.

F. As used in this Section, “Progress Schedule” refers collectively to “Baseline Progress Schedule” and “monthly Progress Schedule updates.”

1.2 PROGRESS SCHEDULE

A. Within seven (7) calendar days after Notice-to-Proceed, the Contractor shall prepare and submit to the Owner, for review and comment, three (3) copies of a preliminary Progress Schedule utilizing a Critical Path Method (CPM) logic based on the Contract Documents. The Owner will review the preliminary schedule for conformance with the Contract Documents and provide comments within fourteen (14) calendar days of receipt from the Contractor. The Contractor shall respond to all comments and provide the Owner a Baseline Progress Schedule within seven (7) calendar days of receipt of the Owner’s comments.

B. Once the Baseline Progress Schedule is submitted to the Owner, the Progress Schedule shall be formally established as the baseline file within the Contractor’s scheduling software. This baseline file shall not be modified without the Owner’s written approval.
   1. The amount specified in Section 01 29 76 shall be withheld from the Contractor's monthly Application for Payment if the Baseline Progress Schedule and Submittal Schedule, referenced in 1.5 of this Section, are past due and such amount may, at the Owner’s sole judgment and discretion, be reduced from the Contract Sum by unilateral Change Order (see Section 01 29 76, "Progress Payment Procedures").
C. The Baseline Progress Schedule shall be the basis that the Contractor shall use to: plan, organize, and execute the Work; record and report actual performance and progress through updates, and; show how the Contractor plans to complete all remaining Work. The Baseline Progress Schedule and monthly Progress Schedule updates shall be the basis for consideration and analysis of requests for time extensions as specified below. The schedule shall be in the form of an activity based precedence diagram.

D. The Baseline Progress Schedule and monthly Progress Schedule updates shall be constructed to show the order in which the Contractor proposes to carry out the Work, and to indicate the restrictions of access to and availability of the work area, and availability and use of manpower, materials, equipment, and all activities of trade contractors, equipment vendors, and suppliers. The Progress Schedule shall incorporate contractually specified limitations and restrictions, and contractually specified milestones. Construction activities shall match or be correlated with the pay items in the approved Schedule of Values. The Progress Schedule shall be prepared in sufficient detail with the assignment and coding of all activities by the Contractor and Subcontractors in consideration of, but not limited to, the following Work activities:

1. Access and availability to the Project Site, including road closures;
2. Identification of interfaces and dependencies with preceding, concurrent, and succeeding contractors, if applicable;
3. The type of work to be performed and labor trades involved;
4. All procurement, manufacturing, fabrication (both on-site and off-site), and delivery activities for all major materials and equipment;
5. Shutdowns of existing Owner’s equipment and utility services;
6. Required delivery dates of OFCI equipment and materials;
7. Testing, air balancing, and commissioning activities, including submission and approval of test results;
8. Approvals by regulatory agencies or other third parties, including obtaining an Occupancy Permit;
9. Coordination for Owner’s occupancy including Owner’s cleaning, OFOI equipment and furnishings installations;
10. Planning for phased occupancy by the Owner, with intermediate completion dates;
11. Contractor’s preliminary cleaning and final cleaning operations;
12. Contractor’s Final Punch List Report, Owner’s Final Inspection (Punch List), Contractor’s corrections, and Owner’s re-inspection;
13. Substantial Completion and Final Completion activities and milestones, and Final Acceptance.

E. The activities defined in the Progress Schedule shall represent the planned durations in anticipation of normal man-power and equipment utilization in durations of whole working days. No activity durations shall exceed twenty two (22) working days. If approved by the Owner, longer durations may be allowed for non-construction activities such as procurement, delivery, or submittal activities. All durations shall be determined based upon resource planning under contractually defined on-site work conditions. In calculating activity durations, normal inclement weather shall be considered. The Contractor shall schedule the Work to minimize the effect of adverse weather. The Contractor shall also protect the work site from the effects of adverse weather or take other necessary measures such that the Work can be completed within the time established in the Contract Documents and include these provisions in the schedule as appropriate.

F. Schedule activity identification codes shall not be alphanumeric unless approved by Owner.

1. Activity Description: Provide adequate information to readily identify each activity up to 48 characters in the general descriptive format: action, item, location (such as Install Steel Studs 3rd Floor).
2. The Critical Path shall be clearly indicated on all diagrams submitted. An activity is critical when it is part of the longest duration pathway(s) through the CPM network or when total float is less than or equal to zero.

3. Clearly identify activities that are planned to use overtime, double shifts, work on weekdays or holidays.

4. Include a listing of activities with open ends and out-of-sequence progress.

G. Certification: When requested by Owner, submit certification that each Subcontractor and major equipment supplier has participated in, reviewed, and concurs with the Progress Schedule as it relates to their Work.

1.3 MONTHLY PROGRESS SCHEDULE UPDATES

A. The Contractor is required to prepare and submit monthly Progress Schedule updates and to participate in monthly schedule update meetings with the Owner as described below.

1. Timely submission of updates is of significant and crucial importance to the management of this Project. Lack of, or late receipt of, updates diminishes their value to the Owner. If a monthly Progress Schedule update is not submitted to and reviewed with the Owner prior to the Contractor submitting its monthly Application for Payment, the monthly Schedule of Values amount for Progress Schedule updates may, at the Owner's sole judgment and discretion, be reduced from the Contract Sum by unilateral Change Order (see Section 01 29 76, “Progress Payment Procedures”).

B. The Contractor shall prepare a monthly Progress Schedule update to reflect work progress achieved since the previous update. Historical performance data and/or records shall not be changed without the approval of the Owner.

C. The Contractor shall use and maintain a fixed end date when generating the required reports and diagrams for the Owner as specified by this Section. The fixed end date shall be the Substantial Completion date. The fixed end date will be adjusted in subsequent updates only to reflect approved time extensions incorporated by Change Order.

D. The Project shall be rescheduled each reporting period with:

1. An updated data date.
2. Actual start/finish dates.
3. Percent complete.
4. Remaining durations (for each activity) in the "status" or "current" file.

E. Show changes occurring since the previous schedule submission, such as:

1. Any major changes in scope.
2. Activities modified since previous submission including, but not limited to, logic changes.
3. Revised projections for progress and completion, as applicable.
4. Any other identifiable changes.

F. The Contractor shall account for all rain days, for major events, and similar excusable non-compensable delays, during which little or no work is progressed and that are acknowledged by the Owner, in the period within which the events occur.

G. The Construction Progress Meeting shall be held prior to Owner’s review and comment of the Contractors draft Application for Payment, unless otherwise approved by Owner.

1. The Contractor shall provide copies of two tabular reports:
   a. A total float report clearly indicating the current critical path through Substantial Completion.
   b. A report of activities sorted by early start dates commencing with the previous monthly progress update and including all updated activities during the previous
month. Actual progress of the previous month will be recorded and incorporated into the update.

2. The Contractor shall provide copies of a narrative report to include:
   a. A description of the Work that has progressed.
   b. An explanation of the Work that had been scheduled to be performed in the previous period but was not performed, and why it was not performed.
   c. Anticipated delay and impact on the schedule.
   d. Corrective action recommended and its effect.
   e. A discussion of the Work scheduled for the upcoming period noting any issues or events that could impact this Work.
   f. If the Contractor intends to make a logic or original activity duration change(s), the report shall include such changes.

3. The Contractor and Owner shall review these reports and discuss any differences or issues raised.

1.4 CHANGE IN CONTRACT TIME ANALYSIS

A. It is the Owner’s desire and intent to resolve all issues affecting the Substantial Completion date in a timely, efficient, and effective manner. To achieve this goal, the Owner and Contractor shall participate in an analysis of all delays and advances of the schedule.

B. Assessment of impacts due to changes or other events must be performed on the most recent update of the Progress Schedule. Further impacts due to changes or other events shall be assessed utilizing the Progress Schedule update that represents the data date closest to, and just prior to, the date of the impacting event.

C. The logic and planning elements of the Progress Schedule are the Contractor’s responsibility.
   1. No Contract Time shall be modified unless directed by an approved Change Order.

D. Submission of a valid monthly Progress Schedule update and the completion of a delay analysis impacting the critical path are conditions precedent to the review and approval of any request for an extension in the Contract Time. Failure to complete monthly Progress Schedule updates and to participate in the analysis will defer consideration of any time extensions by the Owner until the Work is completed and all as-built progress can be analyzed by the Owner. Further, the Owner will assess liquidated damages, if any, regardless of the status of any requests for time extensions pending, until any such requests are resolved.

1.5 SUBMITTAL SCHEDULE

A. General: Within ten (10) calendar days following Owner’s receipt of the Baseline Progress Schedule, the Contractor shall prepare and submit to the Owner a complete schedule of work-related submittals based on the Progress Schedule, as required by the Contract Documents ("Submittal Schedule"). Correlate Submittal Schedule with the listing of principal Subcontractors.

B. Form: Prepare Submittal Schedule in chronological sequence of submittals. Show category of submittal, name of Subcontractor, generic description of work covered, related Specification Section numbers, activity or event code on the Progress Schedule baseline file, scheduled date for first submission, and blank columns for actual date of submittal, re-submittal, and final release or acceptance by the A/E. The Submittal Schedule shall be prepared in sufficient detail and in consideration of, but not limited to, the following:
   1. Preparation and submission of shop drawings, layout drawings, product data, material samples, and mock-ups.

C. Update the Submittal Schedule monthly and submit to Owner.
1.6 SHORT INTERVAL SCHEDULE

A. Short Interval Schedule: Prepare and update weekly a four (4) week Short Interval Schedule. Show previous week of actual progress (planned vs. actual performance). Forecast three (3) weeks of start and completion dates for each activity, task, or event in comparison to the Contractor’s Construction Progress Schedule.
   1. Activities in the Short Interval Schedule shall relate directly to activities in the Progress Schedule.

B. Format for the Short Interval Schedule should be similar to the Owner’s form. The Contractor may submit an alternative format that must first be approved by the Owner. The format shall include comment annotation as necessary.

C. Copies of the Short Interval Schedule shall be provided at the Construction Progress Meetings and will be used as the basis for discussion of progress and planned work at the meetings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies general administrative and procedural requirements for submittals required by the Contract Documents.

1.2 SUBMITTAL PROCEDURES

A. The Owner intends to utilize an internet-based construction management system (CMS) for submittals (see Section 01 35 00 “Electronic Communications”).
   1. The electronic submittal process is not intended to be used for color samples, color charts, or material samples.

B. Coordination: Contractor shall review submittals for completeness, accuracy, and compliance with the Contract Documents, and shall coordinate the transmittal of submittals to ensure there is no delay in the construction Progress Schedule. Submittal sequencing should coincide with the Contractor’s Submittal Schedule.
   1. Allow fourteen (14) calendar days turnaround for each submittal, from time of receipt by the Owner. For complex submittals or submittals requiring coordination with subsequent submittals, plan additional turnaround time.
      a. Provide a "Priority List" when submitting several submittals within a short time.
   2. A/E reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
   3. Submittals received from sources other than Contractor will be returned without action.

C. Submittal Preparation: Contractor shall place a label on each submittal for processing. Include the following information on the label:
   1. Date
   2. Owner’s Project name
   3. Name of Contractor and submittal number
   4. Name of the entity that prepared the submittal
   5. Specification reference number
   6. For Shop Drawing submittals, Contractor’s certification that the submittal has been coordinated and reviewed for compliance with the requirements of the Contract Documents, and is approved for A/E’s action

D. Submittal Transmittal: Contractor shall include a transmittal with each submittal package.
   1. Address no more than one topic, or related topics, on a single transmittal (i.e., mechanical items shall not be submitted with electrical items; miscellaneous specialties shall not be grouped; shoring shall be submitted separate from foundations).
   2. Record relevant information including, but not limited to: the requested review return date (in order to maintain the construction Progress Schedule) and for Shop Drawings, variations from the requirements of the Contract Documents.
   3. Provide the minimum number of each required submittal as noted in the Contract Documents and/or as follows:
      a. Shop Drawings: one (1) PDF
      b. Product data: one (1) PDF
      c. Samples: five (5) samples
      d. Mock-ups: As required by the Contract Documents
      e. Reference the Contract Documents for additional submittal requirements
   4. Material and Color Samples: Submit samples of actual materials and colors.
a. Where variation in color, pattern, texture or other characteristics are inherent in the material, submit no less than four (4) variations of each sample to show approximate limits of the variations.

E. Portable Document Format (PDF) Requirements:
1. All documents are to be created as PDF files from the original source files, unless approved otherwise in writing by Owner.
2. The CAD printer shall be Autodesk DWG to PDF.pc3 print configuration.
   a. Layer information shall not be included.
3. All documents are to be created with a resolution of not less than 300 dpi.
4. All fonts are to be embedded in the PDF.
5. When compression is used, the algorithm must be LZW, CITT Group 4, or PackBits.
6. The PDF document size must be the same as the original document size if the document were printed (e.g., a 24"x36" print should have a PDF sheet size of 24x36).
7. Each document must be submitted as a single file.
   a. A single O&M product reference is one file.
   b. A single drawing is one file.
   c. A document larger than 11"x17" is defined as single document and is one file.

F. A/E’s Action: Except for submittals provided for the Owner’s information, the A/E will: review each submittal, mark each submittal with a uniform self-explanatory action stamp indicating action taken, and return promptly. Typically action stamps indicate:
   1. Accepted without exception;
   2. Subject to noted corrections;
   3. Returned for re-submittal after correction; and
   4. Rejected as non-compliant with the Contract Documents.

G. Compliance with Contract Documents requirements is the Contractor’s responsibility.
1. A/E’s approval of submittals does not relieve the Contractor from responsibility for a proper installation, compliance with applicable codes, or coordination of the Work.
2. All submittals required by the Contract Documents will be reviewed by the Owner for CAD drafting compliance, PDF compliance, and to determine completeness of the documents provided.

1.3 SHOP DRAWINGS

A. General: Shop Drawing submittals are defined in the General Conditions and include, but are not limited to, product data, samples and mock-ups, and layout drawings.
   1. Do not reproduce Contract Documents as Shop Drawings.
   2. For CAD Shop Drawing submittals, see 01 77 00 “Closeout Procedures.”

B. Product Data: Product data includes manufacturer’s printed installation instructions, catalog cuts, standard color charts, rough-in diagrams and templates, standard wiring diagrams, and performance curves.
   1. Submittal of standard product data is acceptable only when specific reference to the requirements of the Contract Documents is included. Submit specially prepared manufacturer’s product data when standard product data is insufficient.
   2. Mark each product data submittal and show the following information:
      a. Compliance with specified product requirements, including LEED requirements
      b. Compliance with any specified industry standards and testing agency standards, with testing agency labels and seals
      c. Manufacturer’s printed recommendations
      d. Applicable choices and options
      e. Notation of coordination requirements
f. Notation of dimensions established by field measurement, as appropriate

C. Samples and Mock-ups: Samples include, but are not limited to, actual colors, materials and products to be provided. Mock-ups include field installations and partial assemblies of components.
   1. Prepare samples to facilitate review. Provide the following information:
      a. Generic description of the sample
      b. Source of the sample
      c. Confirmation of availability and delivery time
   2. Where samples are for selection of appearance characteristics from a range of standard choices, submit a full set of choices for the material or products.
   3. Maintain sets of approved samples and mock-ups at the Project site for quality comparisons throughout the course of construction.

D. Layout Drawings: Drawings include, but are not limited to, fabrication and installation drawings, layouts, schematics, diagrams, schedules, patterns, and templates.
   1. Submit drawings drawn to accurate scale. Indicate, at a minimum, the following information:
      a. Dimensions
      b. Identification of products and materials included
      c. Compliance with product installation requirements and/or industry standards
      d. Notation of coordination requirements
      e. Notation of dimensions established by field measurement

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for electronic communications and document control between the Owner, A/E and Contractor in supporting the Work of the Contract Documents.

B. The Owner will provide the Contractor and its Subcontractors access to the Owner’s internet-based integrated construction management system (CMS) which shall be used for communications and document control.
   1. Not all Project documents are tracked in the CMS. For most documents not in the system, the Owner provides electronic forms created with other industry standard software.
   2. Owner’s forms are included in Appendix A of these Specifications.

1.2 ADMINISTRATIVE REQUIREMENTS

A. System Access: The Owner will provide the required access codes necessary for the Contractor’s access to the Owner’s CMS website. The Owner will host the software and administer authority levels and classifications to users to control security access. Access levels will be provided to match only the level necessary to maintain and process electronic documents specified in this Section.
   1. Owner shall not be responsible for temporary or intermittent outages.

B. System Users: The Contractor shall provide a list of all parties from the Contractor’s and Subcontractors’ staffs and others that will be given access to the system. The Owner will provide the Contractor with access for a maximum of four (4) users, unless otherwise requested by the Contractor and approved by the Owner. The Contractor may, at its sole discretion, elect to enter all required data into the system including input from Subcontractors or may require the Subcontractors to enter their own data, but in either case the Contractor will be responsible for the accuracy of the data entered.

C. System Training: The Owner will provide initial training in the use of the CMS website at no cost to the Contractor commensurate with requirements for document control specified in this Section.
   1. The Owner will provide a training seminar for up to four (4) representatives from the Contractor’s organization at no cost to the Contractor. A training location and dates for the training will be provided after the award of the Contract. Training is anticipated to begin within two weeks of Contract execution.
   2. Additional training requested by the Contractor shall be subject to approval by the Owner.

D. Documents Requiring Signatures: All documents requiring signatures for approval shall be processed with the CMS to expedite preliminary concurrence of information only. Receipt of a “hard copy” signature on forms is required prior to implementing action or work as the conditions may require.

E. Equipment and Software Requirements: A computer with high speed internet access will be required in the Contractor’s home office and field office and in the offices of each of its Subcontractors using the CMS. Each computer must utilize Internet Explorer 8 or above and must be equipped to handle current versions of Microsoft Excel and Word documents, as well as pdf and tif files.
F. Information Input: The responsibility of the Owner, A/E, and Contractor to enter information and data into the Owner’s internet-based CMS shall correlate with the responsibilities of the same parties as specified in all other sections within these Contract Documents. Responsibilities include, but are not limited to:

1. The Owner will input Project and cost information from the Contract Award and maintain emergency contact lists, reports, logs, and enter all change documents.
2. The A/E will enter the Contract Documents and design clarifications with attached drawings and details, after Owner’s approval, and field reports.
3. The Contractor will enter all meeting minutes, submittals, utility shutdown requests, Requests for Information and other reports and documents required by the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies minimum requirements for safety on the construction site including:
   1. Contractor responsibility (regarding safety)
   2. Contractor safety program and plan submittals
   3. Contractor safety requirements
   4. Contractor safety reporting
   5. Construction “fire safety” requirements
   6. Chemical hazard communication
   7. Chemicals of interest reporting
   8. SARS-CoV-2/COVID-19 exposure control, mitigation, and response plan
      Note: Refer to the UW Project Delivery Group (PDG) website for information on current regulatory/agency guidelines and University requirements (https://facilities.uw.edu/unit/project-delivery)

B. Owner’s forms referenced in this Section include (see Appendix A):
   1. Chemicals of Interest – Contractor Declaration and Reporting Form

C. For additional provisions related to safety precautions, refer to the General Conditions.

1.2 CONTRACTOR RESPONSIBILITY

A. The Contractor is solely and completely responsible for compliance with all applicable laws, codes and regulations regarding safety (whether noted in this Section or not) and for creating and maintaining a safe working environment, including safety of all persons and property on the jobsite (whether the requirements of this Section address a particular situation or not).

B. The Contractor shall maintain the jobsite and perform the Work in a manner which meets or exceeds statutory and regulatory requirements for the provision of a safe place to work and which minimizes safety risks to personnel of the Contractor, Subcontractors, Owner, general public or other parties. This obligation shall apply continuously and not be limited to normal working hours.
   1. The Contractor shall ensure that all Contractor and Subcontractor personnel are provided sufficient training, and shall take such actions as are necessary to maintain a safe environment on the construction site. Such training and actions shall include, but not be limited to, ensuring that such employees are familiar with governing construction safety requirements and the requirements for compliance with applicable regulations.
   2. The Contractor shall monitor the jobsite to ensure that employees do not create unsafe conditions for others, and to comply with the provisions of the Site Specific Safety Plan.
   3. The Contractor shall establish and communicate clear expectations to its employees and Subcontractors of any tier (and their employees) of their obligation to notify the Contractor and any at risk party of any potential health or safety hazard affecting themselves or others.
   4. The Contractor shall conduct on-site safety meetings weekly, or other frequency as appropriate, that shall be mandatory for all employees.

C. The Contractor shall designate a full-time on-site competent individual to be the “Safety and Health Officer” who is qualified and authorized to supervise and enforce compliance with the Contractor’s Site Specific Safety Plan during the performance of the Work. The Contractor is responsible to ensure that all necessary monitoring equipment, protective clothing, and other supplies and equipment are available to implement the Plan.
1. The Contractor shall require each Subcontractor to provide a fulltime on-site safety manager (competent individual) for the duration of work at the Project site. If the man-load is below fifty (50) field workers, the Subcontractor may designate its Superintendent as the safety manager. If the man-load is fifty (50) or above field workers on-site, the Subcontractor shall provide and designate a dedicated competent individual as safety manager whose sole responsibility is Project safety including, but not limited to: review pre-task plans, critical lift plans, rigging and installation means and methods, fall protection, trenching excavations, electrical safety, Occupational Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act of 1973 (WISHA) regulations compliance, and second tier Subcontractor safety monitoring and compliance.

D. Safety Violations: In the event of WISHA violations by the Contractor or any of its suppliers or Subcontractors of any tier for unsafe practices involving imminent danger to personnel of the Owner, Contractor, Subcontractors, or others, the Contractor shall immediately correct the hazardous situation which caused the violation prior to any work continuing in the affected area. If such violations exist and corrective actions have not been taken by the Contractor, the Owner may order the Contractor to stop work (to be followed up in writing the same day), until satisfactory corrective action has been taken per Article 3.04 of the General Conditions.

1.3 CONTRACTOR SAFETY PROGRAM AND PLAN SUBMITTALS

A. Company Safety Program: The Contractor shall submit a copy of its Company Safety Program to the Owner. The Company Safety Program shall contain, at a minimum, the following elements:
   1. Organizational Structure: Include names of individuals who will perform safety duties, titles, work assignments, authority and reporting relationships.
   2. Training Program: Who, how, and when training is provided; method of employee training concerning safety rules and procedures; and training in use of protective equipment.
   3. Protective Equipment: List of personal protective equipment to be provided to employees.
   4. Accident Prevention and Loss Control Plan: Work site inspection and hazard correction procedures; disciplinary procedures for safety infractions; and accident response (investigation and reporting procedures).

B. Site Specific Safety Plan: The Contractor and each of the Contractor’s Subcontractors shall review the Contract Documents, and the Contractor shall develop and submit a copy of a “Site Specific Safety Plan” to the Owner. The Site Specific Safety Plan shall be tailored to the unique issues of the Project and the specific types of hazards likely to be encountered throughout all phases of the Work, be in compliance with WISHA and all other regulatory requirements, and contain, at a minimum, the following elements:
   1. Application of Company Safety Program: The Site Specific Safety Plan shall address how the elements listed in this Section 1.3A will be specifically applied and modified in addressing the unique issues related to the Project.
   2. Specific Hazards: The Site Specific Safety Plan shall address, as applicable, the following, and other specific hazards for the Project:
      a. Odor notification
      b. Excavation and rescue plans
      c. Pedestrian safety (including on Husky Game and/or other special event days)
      d. Overhead hazards and flying objects
      e. Hot works
      f. Hazardous materials and chemical exposure
      g. Methane abatement
      h. Safety issues related to Owner’s “Prior Occupancy”
      i. Working over water
      j. Rigging - aerial lifts and forklifts
k. Electrical safety
l. Scaffolding and personnel lifts
m. Noise and dust
n. Lockout/Tagout and control of hazardous energy
o. Work in confined spaces
p. Housekeeping and safe access
q. Silica
r. Fall prevention
s. Steel erection activities
t. Crane safety
u. SARS-CoV-2/COVID-19 viruses

1.4 CONTRACTOR SAFETY REQUIREMENTS

A. Safety Training: Contractor shall provide construction site orientation for all employees (including Subcontractor employees) to become familiar with the Site Specific Safety Plan prior to commencing work. Contractor shall, on a weekly basis, perform safety training on hazards specific to the phase of work for all employees. These meetings shall be mandatory for all construction employees.
   1. Subjects should include site specific safety issues and procedures and discussion of corrections resulting from any violation in safety procedures. A log of subjects covered and a copy of the attendance records of each meeting shall be submitted to the Owner's Representative on the day the meeting occurs.

B. Respiratory Equipment: Any personnel performing work requiring the use of respiratory protective equipment shall be fully trained in the use of such equipment. Contractor must have a respiratory protection program and ensure that all workers wearing respirators have medical clearance and fit testing, as appropriate, for the type of respirators used.

C. Personal Protective Equipment: Contractor shall ensure all construction personnel are equipped with and utilize personal protective equipment in accordance with Labor and Industries standards. As a minimum requirement, all personnel working on the construction site shall be required to use approved hardhats, safety glasses, appropriate gloves, and substantially constructed work boots. In addition, high-visibility safety apparel shall be worn in accordance with the American National Standards Institute and the International Safety Equipment Association (ANSI/ISEA) standard 107-2004.

D. First Aid: The Contractor shall maintain at the Contractor's field office, or other well known place at the Project site, all materials (e.g., a first aid kit) necessary for giving first aid to the injured, and shall establish, publish, and make known to all employees procedures for ensuring immediate removal to a hospital or a doctor's care, persons (including personnel) who may have been injured on the construction site. Construction personnel shall not work on the construction site before the Contractor has established, and made known, procedures for removal of injured persons to a hospital or a doctor's care. If the Contractor and/or any Subcontractors work crew consist of five or more employees, the Contractor shall ensure that at least one of such employees has a valid and effective first aid card.

E. Safety Walkthrough: In addition to WISHA requirements, the Contractor shall conduct a safety walkthrough of the Project with the Owner's Representative a minimum of once a month during the course of construction. If a safety manager is required for any Subcontractor, the safety manager shall also attend the safety walkthrough. The Contractor shall:
   1. Document and maintain a written record of the hazards and unsafe practices noted during the walk-through and provide copies to the Owner as requested;
   2. Ensure that corrective action is promptly taken to eliminate the items recorded; and
3. Maintain copies of all inspections performed by other competent individuals on the construction site during the course of construction.

F. Job Hazards Analysis: The Contractor shall plan daily work, considering procedures with the potential for personnel injury and implement appropriate practices to avoid injuries with focus on engineering controls, personal protective equipment needs, and mitigation for exposure to cuts and lacerations. At each construction progress meeting, the Contractor shall present its plan for addressing hazards likely to be encountered in the next week.

1. The Contractor shall develop and implement a program requiring task planning at the foreman level, including at the Subcontractor’s foreman level.

1.5 CONTRACTOR SAFETY REPORTING

A. Reporting Injuries and Incidents: Contractor shall immediately notify the Owner’s Representative of any injury or incident to persons, including personnel, on the construction site. Contractor shall conduct an immediate investigation with an emphasis on preventative actions and lessons learned. The Contractor and its Subcontractor shall document the investigation and submit a hard copy of the report on OSHA Form 301 “Injury and Illness Report,” or equivalent, to the Owner within 24 hours of the incident. The Contractor shall report on a monthly basis the total number of hours worked on-site by the Contractor’s employees and Subcontractors, and the total number of recordable incidents and lost time accidents. Contractor shall submit copies of the Project First Aid Log to the Owner’s Representative on a monthly basis.

B. Reporting Potentially Serious Hazards: Contractor shall immediately notify the Owner’s Representative of any potentially serious hazard to persons, including personnel, on the construction site. Contractor and its Subcontractor shall conduct an immediate investigation and submit a report to the Owner’s Representative within 24 hours of becoming aware of the potentially serious hazard. The report shall describe the potentially serious hazard, the results of the Contractor’s investigation, and any steps the Contractor has taken to prevent an injury or incident from occurring based on the potentially serious hazard.

C. Emergency Procedures:
   1. For emergencies requiring an ambulance, fire department, or police assistance, the Contractor shall call emergency services (fire and police at 911).
   2. Should the Contractor find it necessary to call for non-emergency police assistance or protection in the exercise of the Contractor’s responsibilities on the Seattle Campus, the Contractor shall call the University Police Department at 206-543-9331.
   3. If an emergency incident occurs within the UW Medical Center (UWMC), the Contractor shall also contact UWMC staff by calling from internal UWMC phones.

1.6 CONSTRUCTION FIRE SAFETY REQUIREMENTS

A. Fire Safety During Construction and Demolition: The Contractor shall conform to Chapter 1, “Fire Safety During Construction and Demolition,” of the International Fire Code, as locally amended, and any additional provisions as outlined herein for precautions against fire, flammable and combustible liquids, flammable gases, explosive materials, fire protection, fire reporting, fire fighting access, means of egress, standpipes, fire sprinklers, and roofing operations.

1. The Contractor shall provide adequate separation between Owner-occupied buildings and construction trailers and sheds.

B. Hot Work Procedures:
   1. Contractor shall establish a system for documentation and control of “hot work” activities which include the use of portable gas, grinding, or arc welding equipment and conduct
operations in a manner that is fire-safe for the work area and adjacent areas. Hot work permits are to be posted at the jobsite in an accessible and conspicuous location. Maintain the premise clear of rubbish, debris, or other materials constituting a potential fire hazard. The local fire code is incorporated herein by reference; adhere to all applicable provisions as determined by the local fire department. Contractor and Subcontractors shall obtain from the local Fire Department engineering inspection section a permit for all hot work activities prior to performing this Work.

a. Whenever practical, the Contractor shall perform cutting and welding operations off-site.

2. Maintain copies of all hot work related permits for Owner’s review upon request, including, but not limited to:
   a. Cutting and welding;
   b. Roofing / hot-tar kettle; and
   c. Storage of flammable materials (e.g., propane, butane) and/or compressed gases.

3. Prior to conducting hot work activities, the Contractor shall ensure all of the following fire safety precautions have been taken:
   a. Cutting and/or welding equipment must be thoroughly inspected and found to be in good repair, free of damage or defects.
   b. A multi-purpose dry chemical, portable fire extinguisher must be located so that it is immediately available to the area of work and is fully charged and ready for use.
   c. At least one fire alarm pull station or means of contacting the fire department (i.e., site telephone) must be immediately available and accessible to person(s) conducting the cutting/welding operation.
   d. Floor areas under and at least 35 feet around the cutting/welding operation must be swept clean of combustible and flammable materials.
   e. All construction equipment fueling activities and fuel storage must be located at least 35 feet away from cutting/welding operations.
   f. Fire resistant shields (e.g., fire retardant plywood, flameproof tarpaulin, metal, etc.), must cover combustible floors.
   g. Combustible materials and finished surfaces, equipment, electrical cables, and personnel must be provided with protection to prevent damage or injury from molten metal, falling sparks, and welding arcs.
   h. Spark / slag catchers (e.g., fire retardant plywood, flameproof tarpaulin, metal, etc.) must be suspended below any elevated cutting/welding operation.
   i. All floor and wall openings must be covered to prevent sparks/slag from traveling to other unprotected area.
   j. Containers in or on which cutting/welding will take place must be purged of flammable vapors.

C. Fire SystemsShutdowns, Impairments, and Fire Watch

1. When it is necessary to shut down existing fire alarm systems or suppression systems for switch-over purposes, or any other reason that leaves the building unprotected, the Contractor shall provide a continuous Owner-approved “fire watch” in accordance AHJs and the following (unless the Contractor provides an Owner-approved temporary equivalent system or the Contractor is specifically excepted by the Owner):
   a. Person(s) assigned to a fire watch must be trained in the use of the portable fire extinguisher.
   b. Fire watch personnel must have an immediate means of providing notification to the fire department (e.g., cellular phone, land-line phone, two-way radio to a continuously staffed position) and the University Police.
   c. Continuous rounds to cover all areas of the building where the fire protection system is out-of-service are required every 15 minutes.
   1) Exception for Building Code type “B occupancy” buildings: During the hours a B occupancy building is occupied, building occupants performing their duties,
including construction personnel, may act as a fire watch in lieu of a designated fire watch, when approved in writing by Owner.
   a) A fire watch is required at all times in unoccupied areas.
   b) Other building code occupancy types may be allowed this exception when approved in writing by the Owner.

d. A log of rounds shall be maintained to include the name of the person performing the fire watch, the hours worked (including start and stop times), and comprehensive notes.

2. Fourteen (14) calendar days written notification shall be provided to the Owner’s Representative requesting approval for fire protection system shutdown or functional impairment; receipt of written approval from the Owner’s Representative is required before any system shutdown or functional impairment.
   a. In occupied buildings, include a plan indicating a method to notify all occupants.
   b. Notify the local fire department. In Seattle, the number to report out-of-service systems and equipment is 206-233-7219.

3. The Contractor shall work in cooperation with the Owner to identify fire alarm initiating devices in and adjacent to the Project site that may activate from construction activities (i.e., work that creates dust, smoke, steam, heat, etc.) and develop a plan to temporarily cover, remove, or disable through programming these devices to eliminate the potential for false alarms.
   a. The Owner may authorize in writing some devices to be disabled for the duration of the Work or for a particular activity without requiring a continuous “fire watch” for one shift or several days depending on circumstance.
   b. ONLY OWNER PERSONNEL SHALL DEACTIVATE OR DISABLE EXISTING FIRE DETECTION AND SUPPRESSION SYSTEMS, unless the Contractor is specifically authorized in writing by the Owner to do so.

D. Fire Alarm/Suppression Systems False Activation or Discharge: Most existing Owner buildings have active fire detection and suppression systems. If proper procedures as outlined in the Contract Documents and this Section 1.6C are not followed to ensure the unnecessary activation or deactivation of these systems, the Owner may at its sole discretion impose an emergency response charge of $350 per occurrence to the Contractor and require a fire watch at the Contractor’s cost. The Contract Sum will be amended for such amount by Change Order.

E. Fire Extinguishers Required for Construction: Provide multipurpose dry chemical portable fire extinguishers for the Work in accordance with the International Fire Code Chapter 14, as locally amended, and as required by WISHA and other applicable regulations. Existing building fire extinguishers or new fire extinguishers specified by the Contract Documents for the Project do not alleviate Contractor’s responsibility to provide temporary fire extinguishers for the Work.

F. Standpipes Required for Construction: In new multi-story construction (four or more stories in height) a Class I standpipe shall be provided in accordance with Chapter 14 of the International Fire Code, as locally amended, for use during construction. Fire Department connections at bottom of standpipe shall be clearly marked and accessible at all times for fire department personnel and equipment. This requirement shall be reviewed and approved by the Owner’s Representative.

G. Existing Fire Separations: Existing fire separations, including floor-to-floor separations, shall not be impaired by construction activities.

H. Occupant Egress in Existing Buildings: The Contractor shall not block active exits, exit hallways, exit corridors and the exit access to a public way.
1. Exits are to remain free of construction materials, equipment, and rubbish at all times, unless approved by Owner.

I. Emergency Access: Outdoor storage and staging operations and construction fencing shall not impede egress, restrict or narrow firefighting access (including roads or lanes), or present a fire exposure to existing buildings.
   1. Access to emergency services including, but not limited to, fire hydrants, fire department connections, fire command centers, fire alarm panels, valves and similar equipment and systems for emergency vehicles and emergency response personnel must be kept free and unobstructed at all times, unless specifically approved by the Owner.
   2. Temporary obstruction of emergency access may be allowed for special cases (e.g., crane installations and hoisting) on a short-term basis. A written plan must be submitted to the Owner for approval at least two weeks prior to the scheduled date of obstruction.

1.7 CHEMICAL HAZARD COMMUNICATION

A. General: The Owner and the Contractor are responsible under the Washington Administrative Code 296-800-170 through 296-800-18020 (Employer Chemical Hazard Communication) to provide a safe and healthy environment for their employees.

B. Responsibilities:
   1. The Owner maintains a centralized collection of all Material Safety Data Sheets (MSDS) for Owner materials. These MSDS are available to the Contractor if an unknown chemical is discovered in the work area; a worker is concerned about exposure; and the Contractor suspects the material originates with the Owner.
      a. The Contractor shall coordinate with the Owner’s Representative to receive this information.
   2. The Contractor shall establish a Chemical Hazard Communication Program (WAC 296-155-180) which includes multiemployer workplaces (WAC 296-800-17007), and provide hazard communication information and training to its employees and the employees of the Contractor’s Subcontractors (of any tier).
      a. The information shall include: signage demarcating regulated areas and entrances; signage indicating the location of the Contractor’s binder containing all MSDS used for Construction; and prominently posted lists identifying all hazardous chemicals present in the workplace.
      b. In addition to MSDS training which is regulated by the Employer Chemical Hazard Communication standard, training shall include those MSDS that are available for any Owner's chemical product present at the jobsite.
   3. The Contractor shall provide the Owner chemical hazard information (MSDS) for all chemical products the Contractor and the Contractor’s Subcontractor’s (of any tier) bring onto the jobsite for Owner’s information prior to application including, but not limited to, all paints, glues, mastics, epoxies and cleaning products.
      a. At the jobsite, the Contractor shall establish and maintain a binder(s) of all hazardous chemicals MSDS used for Construction and indicate where utilized.
         1) The MSDS shall be bound in a slant-D, 3-ring, view binder with clear vinyl overlay inserts on the front cover and spine. The binder shall have heavy duty nylon reinforced hinges.
         2) The binder shall have a cover slip sheet and a spine sheet typed with "MSDS used for Construction," University Project name, University Project number, University Facility number, A/E name, and Contractor name.
         3) The MSDS shall be organized by specification division and section with tabbed dividers between the sections or, when presented in a logical format by Contractor and approved by Owner, between categories.
1.8 CHEMICALS OF INTEREST REPORTING

A. Prior to work being performed by the Contractor and/or the Contractor’s Subcontractors (of any tier), the Contractor shall submit to Owner a completed “Contractor Declaration and Reporting Form for Department of Homeland Security – Chemicals of Interest” for chemicals listed in 6 CFR (Code of Federal Regulations) Appendix A to Part 27 that will be used on the jobsite. Individual declarations shall be provided by the Contractor and the Contractor’s Subcontractors (see Appendix A of the Specifications for a copy of the form).

1.9 SARS-CoV-2/COVID-19

A. All construction operations must comply with the most current COVID-19 related rules and guidance from the Governor’s Office including the “Stay Home, Stay Healthy” addendum, dated April 24, 2020, and additional guidance issued April 29, 2020. All activities must also comply with all related and applicable requirements issued by the Washington State Department of Labor and Industries and Public Health Agencies having jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies minimum administrative and procedural requirements that the Contractor shall implement for “infection control” as extensions of other provisions in the Contract Documents.

1. All construction work at a medical center is a potential health risk in that mold spores and other microbial organisms that result from the disturbance of dust can become exposed and airborne which may cause disease in sensitive patients. The Contractor shall:
   a. Not allow any dust to escape the work area within the medical center;
   b. Control any dust, due to construction Work, from entering the medical center; and
   c. Minimize dust and debris from construction operations.

B. Definitions of Construction Activities

   A. “Inspection and Non-Invasive Activities” (Applies to Low Risk, Medium Risk and High Risk Patient Groups): Lifting of ceiling tiles or opening of hard ceiling access panels for visual inspection only; painting (but not sanding); application of wall coverings; and other Owner approved activities which do not move or mobilize uncontrolled dust or require cutting of walls or floor coverings, such as electrical trim work and minor plumbing. (Inspection and Non-Invasive Activities do not include opening access doors in HVAC ductwork.)

   1. Uncontrolled and uncontained Inspection and Non-Invasive Activities are not permitted in “highest risk” patient areas.

   B. “Standard Risk Activities” (Applies to Low Risk, Medium Risk and High Risk Patient Groups): Small scale, short duration activities that are completed in a single work shift and/or that create minimal dust where dust migration is completely contained and controlled from dispersing into the atmosphere, such as installation of energy limited cabling (e.g., telephone, computers), access to chase spaces, cutting of walls or ceilings, and the performance of Inspection and Non-Invasive Activities in “highest risk” patient areas.

   1. Standard Risk Activities are not permitted in “highest risk” patient areas without proper infection control practices to contain dust and debris.

   2. During construction, the Contractor shall ensure:
      a. There is an active means to prevent airborne dust from dispersing into the atmosphere.
      b. Unused enclosure doors are sealed with painter’s tape.
      c. HVAC system air vents (supply and exhaust) within enclosures are sealed shut.
      d. Dust containment (sticky) mats are located at entrance and exit to work area enclosure doors.

   3. Upon completion of the Project, the Contractor shall ensure:
      a. Work surfaces are cleaned and wiped with approved disinfectants.
      b. The work area is damp mopped and/or vacuumed with a HEPA filtered vacuum.
      c. HVAC system isolation is removed and functioning within original conditions or new design standards.

   C. “High Risk Activities” (Applies to all Patient Risk Groups): All requirements specified herein apply to any Work that generates or disturbs a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies, such as sanding of walls for painting or wall coverings, removal of floor coverings, ceiling tiles and/or casework, and new wall construction. Also, includes HVAC ductwork and electrical work above ceilings, major cabling work, and any activity that cannot be completed within a single work shift.
1.3 TYPES OF PATIENT “RISK GROUP” AREAS

A. Low Risk Areas
B. Medium Risk Areas
C. High Risk Areas
D. Highest Risk Areas

1.4 PROJECT RISK GROUP

A. The Risk Group(s) for this Project are “Low Risk Areas.”

1.5 DESCRIPTION OF GENERAL REQUIREMENTS

A. The Contractor shall identify a competent person responsible for establishing, coordinating and maintaining infection control interventions and safety training for the Project who shall be on-site at all times during the Work.

B. The Contractor shall submit a written “Infection Control and Monitoring Plan” for Owner’s review and approval prior to performing Work within the medical center. The plan shall include, but not be limited to, locating dust proof enclosures, HEPA equipment locations and negative air routing, fire safety and security, noise and vibration control, construction access and exit path routing, temporary signage design and locations, odor control, waste management, and proposed cleaning equipment.
   1. Submit temporary facilities drawings showing the locations of dust proof enclosures and negative air machines, with ductwork routing, required for performance of the Work.
      a. For relocations required by the Work, revise and resubmit.
   2. Submit a water control plan for concrete core drilling and saw cutting.
   3. When requested by Owner, the Contractor shall assist in completing the Owner’s “Infection Control Risk Assessment” forms to identify the appropriate interim life safety measures required for the Work.

C. Daily Reports: Contractor shall submit daily infection control reports that document:
   1. A general description of the activities completed during the shift;
   2. Infection Control enclosure checks and modifications, if necessary;
   3. Manometer readings; and
   4. Next-day work plans.

D. Infection Control Training: The Contractor shall provide jobsite orientation for all construction personnel and suppliers of materials to the Project site to become familiar with the Project specific infection control requirements prior to performing any on-site construction activities.
   1. For Projects at the UW Medical Center only: All construction personnel involved in construction activities shall observe a training video “Dust Containment in a Medical Setting” on construction risks in health care facilities as part of their safety training.

E. All infection control requirements shall be in place before commencing Work and shall remain in place and be maintained in good working order until the Work is complete, including but not limited to completing the following work:
   1. Punch List work is fully and finally complete;
   2. Door locks/keys are changed over;
   3. Owner’s air sampling has met infection control completion criteria, and;
4. Contractor’s final cleaning and/or Owner’s transplant cleaning and disinfection is complete.
   a. Contractor’s final cleaning shall occur after Punch List work is complete to the satisfaction of the Owner.

F. Contractor shall not permit its employees, the employees of its Subcontractors of any tier, or delivery personnel to expectorate (spit) inside Owner’s facilities.

1.6 INFECTION CONTROL REQUIREMENTS

A. Dust Proof Enclosures: The Contractor shall provide dust proof enclosures for all Work (except for Owner approved “Inspection and Non-invasive Activities”). Dust proof enclosures shall be constructed per the requirements of Section 01 50 00 “Temporary Facilities and Controls” prior to start of Work. Dust proof enclosures must: enclose the entire work area to completely isolate it from all surrounding areas; cut off any flow of particles from work areas to patient areas; and be functioning continuously. Doors shall remain closed and penetrations or openings to dust proof enclosures shall be tightly sealed at the end of each work shift.
   1. All dust proof enclosures shall be maintained on a daily basis to ensure proper airflow, appearance, and workplace security. Enclosure failure requires immediate corrective action by the Contractor.
      a. Enclosures which are not immediately repaired by the Contractor may be repaired by the Owner and all Owner costs required to repair the failure may, at the Owner’s sole discretion, be back-charged to the Contractor.
   2. When performing construction activities of a “high risk” classification, in highest risk patient areas, an anteroom to the enclosure entrance shall be required.
   3. Portable mini enclosures shall be equipped with a HEPA vacuum for vacuuming the work area prior to removing the enclosure.
   4. On phased projects, where dust proof enclosures are to be relocated as a part of the phasing of the work area, the work area shall be fully cleaned prior to the relocation of any dust proof enclosures to prevent dust from leaving the work area.

B. Work Area Air Pressure Requirements: The Contractor shall use negative air machine equipment to maintain a negative air pressure relationship of the work area from surrounding areas. Negative air pressurization of the work area is required at all times, and constant maintenance of that pressure differential is the responsibility of Contractor, unless exempted in writing by the Owner. A minimum negative pressure relationship of .03” water column must be maintained between areas under construction and surrounding areas.
   1. Appropriate equipment shall be used to constantly monitor the negative air pressure relationship. Acceptable options to visually assure negative air pressure is maintained are: for rigid wall containment (usually in longer duration projects) manometer units shall be employed; for plastic or polypropylene dust proof enclosures (in longer duration projects) flutter strips of light weight ribbons or “survey tape” shall be employed; and for short duration projects involving single shifts the actual visual movement of the plastic or polypropylene dust proof enclosure wall into the construction space is acceptable.
      a. For projects utilizing manometers: The Contractor shall record manometer readings at the beginning and the end of each work shift and shall maintain a log of readings, and any corrective actions taken, to be included in the daily report.
   2. Work area ventilation must be exhausted 100% to the exterior of the building and directed away from building air intakes to an approved location, unless otherwise approved in writing by the Owner.
      a. If the Owner agrees exhausting to the exterior of the building is not feasible, HEPA filtered air may be exhausted to adjacent areas provided existing air relationships remain unchanged and the Contractor provides confirmation with an air balancing report. The air balancing report shall be provided to the Owner prior to the Contractor performing construction work.
1) When exhausting indoors, exhaust near the ceiling through a velocity reducing pre-filter material approved by the Owner. Never exhaust into existing air ducts.

A. Negative Air Machines: The Contractor shall utilize Owner-approved HEPA equipped air filtration "negative air" machines and heavy duty flexible steel reinforced exhaust hoses.
3. HEPA equipped air filtration machines shall be connected to normal power and ganged to a single switch for emergency shut-off.
4. Exhaust hoses shall be of adequate size to ensure necessary air flow and be in place and intact at all times.
5. The Contractor is to take care in maintaining the negative air machines in accordance with the manufacturer’s written instructions, including but not limited to, monitoring and changing all filters and seals as needed to ensure adequate airflow and complete filtering.
6. The Contractor shall provide all necessary HEPA filters for the negative air machines.

C. Materials and Material Handling: The Contractor shall ensure that all materials, including new materials, construction debris, and tools, are transported clean and contained or wrapped in “dust impermeable” enclosures when transported within the medical center. Containers and/or carts shall be tightly covered and their open surfaces shall be wrapped and taped closed unless there is a solid lid. Wrappings and/or bags shall be hermetically sealed.
1. Wheels of containers and/or carts shall be wiped clean prior to entering the medical center and entering or leaving the work area.
2. Debris removal shall occur through approved routes and only at times approved by Owner.

D. Owner Air Monitoring: The Owner will perform periodic field inspections and air quality testing inside and outside the work area and will approve removal of dust proof enclosures based upon air quality testing results. If Owner’s air monitoring indicates failure of negative pressurization of the work area enclosure, or Owner’s measurements and/or observations indicate the construction work is releasing particulates, dust, or vapors outside the work area, upon Owner’s notification to Contractor, Contractor shall implement immediate corrective actions to stop such emissions and to prevent future emissions.
1. Air sample results require approximately five (5) days. Areas that “fail” air sampling at the end of the Project will require additional visual inspection, assessment and remediation, with possible repeat cleaning. Retesting will be performed until the work area meets “passing” criteria.

E. Housekeeping:
1. Infection Control Cleaning: The Contractor shall provide infection control cleaning during all construction activities within the medical center.
a. Construction work areas and access routes shall be clean within the medical center. Contractor shall continuously clean all work areas within the Project site and those work areas outside enclosure containment, including construction access routes, free from dust, debris, and construction materials. Clean and disinfect all existing surfaces and materials outside containment that are impacted by construction immediately upon completion of an activity.
b. Damp mop, electrostatic cloth sweep, and/or vacuum with HEPA filtration the construction site and construction access routes during the work and before leaving work areas at the end of a shift to eliminate tracking and dust migration. Prior to the removal of any dust proof enclosures the Project site must be damp mopped and/or vacuumed and all surfaces wiped down with disinfectant. Submit disinfectant for Owner’s review and approval.
1) Quaternary ammonium compounds are required for damp mopping.
2. Maintain sufficient supplies of cleaning equipment on-site including but not limited to: HEPA filtered vacuum cleaners; dust attracting mops; wet mops; brooms; buckets; and clean wiping rags.

3. Any materials capable of absorbing moisture must be fully dried within 48 hours of becoming wet. If material, either new or existing, inside or outside the work area, becomes wet as a result of the Contractor’s actions and is unable to be dried to an “as-new” condition within 48 hours, the Contractor shall remove the materials within the same 48 hour period. Any visible mold growth caused by or observed by Contractor inside the work area must be reported to Owner immediately. Owner will determine corrective actions to be taken in consultation with Contractor.
   a. Materials removed from the work area for this reason shall be replaced with new materials at Contractor’s expense.

4. Contractor shall take measures to control vermin and other pest infestations within the Project site. Food waste is to be removed daily and all food is to be stored in tightly sealed containers that are clearly labeled.
   a. Any visible bird or rodent droppings observed by the Contractor inside the work area must be reported to Owner immediately. Owner will determine corrective actions to be taken in consultation with Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PERFORMANCE REQUIREMENTS

A. The Contractor shall implement the following, but not limited to, work procedures for Work in the medical center:
   1. Construction materials stored on-site shall be kept dry.
   2. Immediately remove spills or excess applications of solvent containing products.
   3. Existing supply and exhaust air grills serving the building HVAC system within dust proof enclosures shall be covered and sealed to prevent airflow and contamination of the duct system at all times.
   4. At the end of the work day, all openings in pipes and ductwork shall be covered or sealed.
   5. Work surfaces are misted with wetting agents to control dust during demolition and while cutting.
   6. Vacuum subfloor surfaces prior to the application of resilient flooring materials.
   7. Concealed spaces shall be vacuumed clean before covering or enclosing, including but not limited to: chases; stud tracks; above ceilings (including top surfaces of ductwork and cable trays); and surfaces covered by resilient flooring materials, casework, and accessories.
   8. Immediately replace any ceiling tile briefly lifted for visual inspection outside of dust proof enclosures. Removed tiles shall not be left open and unattended. Limit tile removal to 1 tile per 50 square feet of area, unless otherwise approved by Owner.
   9. Work shall be performed in rooms where patients are not present, and at least five (5) feet from patients or visitors in ambulatory or general public settings, when approved by Owner.
   10. When an anteroom is required for a dust proof enclosure, all personnel must pass thru the anteroom before leaving the work site and they shall vacuum debris from their person using a HEPA vacuum cleaner or they shall wear cloth or paper coveralls that are removed within the anteroom each time they leave the work site. Anterooms shall be negatively pressurized the same as the associated dust proof enclosures.
   11. All construction personnel and material suppliers entering a dust proof enclosure at a “High Risk Activity” work site in a “Highest Risk Area” shall wear shoe covers. Shoe covers must be changed each time the person exits the work site.
12. Dust proof enclosures shall be removed only after receiving Owner’s written approval of the Project site air quality. Remove dust proof enclosure materials carefully to minimize spreading of dirt and debris associated with the Work.
   a. Mini-enclosures shall be cleaned inside prior to dismantling, to prevent dust from escaping into occupied areas.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. The Section further describes basic Contract definitions, specification format and content explanations, and industry standards in the Contract Documents.

1.2 DEFINITIONS

A. Accepted: The term "accepted" is used in conjunction with the A/E's duties and responsibilities as stated in the conditions of the Contract.

B. Concealed: Spaces out-of-sight such as above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.

C. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the A/E, requested by the A/E, and similar phrases.

D. Exposed: Open to view. For example, pipe installed in a walkway tunnel or pipe installed in a room and not covered by other construction.

E. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar subsequent requirements.

F. Indicated: The term “indicated” refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference.

G. Install: Operations at Project site to place in position for service or use including unloading, unpacking, assembly, erection, placing, anchoring, applying, working-to-dimension, finishing, curing, protection, cleaning, and similar requirements.

H. Installer: An installer is the contractor or another entity engaged by the Contractor, either as an employee, Subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers shall be experienced in the operations they are engaged to perform.

I. Project site: Is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built. Certain construction activities may extend beyond the Project site.

J. Provide: Furnish and install, complete and ready for intended use.

K. Regulations: The term “regulations” includes laws, codes, ordinances, statutes, and lawful orders issued by authorities having jurisdiction (AHJ) , as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

L. Trades: Using terms such as carpentry does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as
It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into divisions and sections based on the Construction Specification Institute’s (CSI) MasterFormat.

1. Title: The Specifications are divided into division and section for the convenience of writing and using. The titles of these are not intended to imply a particular meaning or to fully describe the work of each division, subdivision, or section and are not an integral part of the text which specifies the requirements.

2. Three Part Section: Each section of Specifications has been subdivided into three parts for uniformity and convenience (Part 1 – GENERAL, Part 2 - PRODUCTS, and Part 3 - EXECUTION). These do not imply a particular meaning and are not an integral part of the text which specifies requirements. Where text for one of the parts is lacking due to project requirements, the part title is included followed by the words “Not Used.”

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B. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. The conventions are explained as follows:

1. Abbreviated language: Abbreviated words and meanings used in the Contract Documents shall be interpreted as appropriate. Words implied, but not stated, shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicate.

2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
   a. The words ‘shall be’ are implied wherever a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: All construction shall be in accordance with industry standards. Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with the industry standards in effect as of the Bid date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two (2) or more standards are specified and where the standards may establish, different or conflicting requirements for minimum
quantities or quality levels, the Contractor shall promptly report to the A/E, in writing, requesting a decision before proceeding with the Work.

1. Minimum quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum, within reasonable limits, to comply with these requirements. Indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements.

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound within the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Acronyms or abbreviations, as referenced in Contract Documents are defined to mean the recognized name of the trade association. Names and addresses are subject to change and are believed, but not assured, to be accurate and up-to-date as of the date of the Contract Documents. Refer to the latest edition of the “Encyclopedia of Associations” published by Thomson Gale for a listing of associations and general standards abbreviations.

F. Federal Government Agencies: Names and titles of federal government standard - or Specification-producing agencies are often abbreviated. Acronyms or abbreviations referenced in the Contract Documents may indicate names of standard - or Specification-producing agencies of the federal government. Names are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. General Requirements: Comply with the quality control provisions specified in the Contract Documents and perform quality control testing and inspection, and the surveillance of the Work for quality, unless specifically designated to be performed by Owner.

B. Owner’s forms referenced in this Section include (see Appendix A):
   1. Contractor Quality Control Daily Report

C. Contractor Quality Control (CQC) shall consist of plans, procedures, and organization necessary to provide materials, equipment, workmanship, fabrication, construction, and operations that comply with the requirements of the Contract Documents. CQC shall cover construction operations keyed to the Progress Schedule including, but not limited to, fabrication on-site and off-site, and field and factory tested construction mock-ups.

D. Owner’s special inspection and Testing Agency services are specified in Section 01 45 23 “Testing and Inspecting Services” which may be required to ensure the Work is in accordance with the Contract Documents, except where those tests are specifically indicated to be performed by the Contractor in the Contract Documents. These services do not relieve the Contractor of responsibility for compliance with Contract Documents requirements.

1.2 CQC MEETINGS

A. General Work Plan Meeting: Contractor shall meet with Owner’s Representative and A/E to discuss CQC procedures for the Project. Items for discussion shall include, but not be limited to:
   1. Identification of the Contractor’s CQC Representative;
   2. Interrelationship of Contractor, AE and Owner’s Representative;
   3. CQC administrative procedures and pre-installation work plans;
   4. Submittals and persons responsible for Shop Drawing review;
   5. Forms for recording the CQC program;
   6. Testing, inspections and approvals records;
   7. On-site and off-site fabrication and installation procedures; and
   8. Field constructed mock-ups.

B. Pre-installation CQC Work Plan Meetings: Develop a “CQC Work Plan” for each definable feature of the Work. Complete the work plan and submit to Owner with each notification requesting a pre-installation meeting. The work plan shall serve as the basis for discussion and review of the Contract Documents requirements. The work plan will assist to assure that materials and equipment delivered and assembled for construction conform to Contract requirements, and that control testing and CQC procedures are documented.
   1. When requested by the Owner, the Contractor shall revise a CQC Work Plan and provide the Owner a final CQC work plan with changes addressing comments or clarifications from the A/E and/or Owner’s special inspection services or Commissioning Authority.

1.3 CONTRACTOR QUALITY CONTROL REQUIREMENTS

A. Contractor’s Quality Control Organization: Staff the CQC organization, as required, to perform the activities outlined in this Section and elsewhere in the Contract Documents.
   1. Identify a dedicated full-time “CQC Representative” who shall be on the Project site at all times during progress of the Work, and as appropriate for all work subsequent to
Substantial Completion. The CQC Representative shall have complete authority to take those actions necessary to ensure compliance with the Contract Documents.

2. Identify persons responsible for review and approval of Shop Drawings and other submittals required by the Contract Documents.

B. Qualifications of CQC Representative: The Contractor shall propose and Owner shall approve, in writing, the Contractor’s CQC Representative. The CQC Representative must have construction management experience including prior experience with projects of similar construction, size, and complexity.

1. During progress of the Work, the Owner will monitor and evaluate the performance of the CQC Representative based on the conformance of the Work with the Contract Documents and an assessment of the accuracy, timeliness and completeness of the daily QC Report. If the CQC Representative fails to perform to the sole satisfaction of the Owner, the Contractor shall propose a replacement CQC Representative for the Owner’s approval.

C. Daily Quality Control Reports: CQC Representative shall maintain daily Quality Control (QC) Reports. The QC Reports shall be factual records containing numerical data of the Work and quality control activities and observations, including examination of work areas to verify the substrate upon which new work is to be placed. Submit QC Reports on Owner’s form, or another Owner approved form, by the next workday following the day of the report.

1. CQC Representative shall verify and sign all reports. Verification shall contain the statement that all supplies and materials incorporated in the Work are in compliance with the Contract Documents.

D. Control of On-Site and Off-Site Construction: Contractor’s Quality Control procedures shall include the following phases of control and management for each definable feature of the Work:

1. Pre-installation Meeting: A pre-installation meeting shall be held prior to beginning work on each definable feature of the Work specified in the Contract Documents (see Section 01 31 19 “Project Meetings”).

2. In-Progress Inspection Phase: In-progress quality control testing and inspection, and surveillance of the Work for quality shall be performed continuously to verify that quality standards are maintained throughout the Work. Adjustment to quality control procedures and CQC work plans may be required, based upon the results of the inspections and testing.

a. The Contractor shall:
   1) Discuss quality control procedures at construction progress meetings;
   2) Report the results of the inspections and any changes to quality control procedures in the daily QC Report; and
   3) Revise CQC work plans for Owner’s records, if changes are required.

3. Above-Ceiling Final Inspections: The Contractor shall provide to the Owner a minimum two (2) week notice prior to ceiling installations for the A/E to conduct above-ceiling final inspections.

a. The Contractor shall perform corrective work and provide reasonable time for the A/E to validate the work complete prior to covering from sight.

4. Contractor’s Final Punch List Report: The CQC Representative shall thoroughly inspect all aspects of the construction (including the Subcontractor’s Work) and produce a final punch list report of work requiring correction and/or incomplete work that shall be issued to the Subcontractors with instructions to complete prior to requesting the Owner’s final inspections. The Contractor’s written request for Owner’s final inspection shall certify that all features of the Work are installed and have been reviewed by the Contractor to determine compliance with the Contract Documents.
a. The Contractor’s final punch list report shall be prepared by the Contractor utilizing the Owner’s internet-based construction management system (CMS), in a format acceptable to the Owner.
   1) The report shall include a comprehensive Project room number list and additional entry listings for site work, building enclosure, roofs, and other items not designated with a room number to document the entire Project.
   2) The Owner’s final inspections items will be added to the Contractor’s final punch list report by the A/E.
   3) The Owner will manage the consolidated listing of all open inspection items until all items are signed-off by the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. General Requirements: Comply with the testing and inspection, and correction of Non-Conforming Work provisions specified in this Section and elsewhere in the Contract Documents.

B. Owner’s Responsibilities:
   1. The Owner will select and employ an independent “Testing Agency” to conduct the tests and inspections in accordance with applicable standard methods of the American Society for Testing and Materials (ASTM) or other standards as a requirement of the building permit.
   2. The Owner may provide other special inspection services to inspect and verify that the Work installed is in accordance with the Contract Documents and construction industry standards.

C. Contractor’s Responsibilities:
   1. All other tests and inspections which are required to obtain regulatory approval by Authorities Having Jurisdiction (AHJ) shall be provided by and paid for by the Contractor.
   2. The Contractor shall provide other testing services where specified in the Contract Documents.

1.2 DESCRIPTION

A. Definition: For the purpose of this Section, all references made to Testing Agency, or waterproofing and roofing inspections, or geotechnical consulting firm shall be referred to as those tests or inspections which will be conducted by an inspector provided by the Owner.

B. Testing and Inspection: Materials to be tested and inspected are specified by the Contract Documents. In addition, testing and inspection of other materials maybe required by the building permit or as directed by the Owner or AHJ. Quantities and extent of tests and inspections shall be as specified and/or required by the Owner’s inspector or AHJ.

1.3 QUALITY ASSURANCE

A. Qualifications: The inspector for all work of this Section, except for geotechnical and waterproofing and roofing special inspectors, shall be a registered inspector employed by an approved inspection and/or Testing Agency as listed by the Washington Association of Building Officials (WABO) Special Inspection Registration Program. All inspection personnel used on this Project are subject to being disapproved from the Project at the sole discretion of the Owner’s Representative. Minimum levels of qualifications as stated in the WABO Special Inspection Registration Program for various portions of the required Testing Agency inspections and testing must be complied with.
   1. The special Inspector for waterproofing and roofing must have the required technical knowledge and experience for the product being installed.
   2. The Owner may select a Testing Agency, other than the agency employed by the Contractor, to perform tests required by the building permit.
   3. Geotechnical inspection will be performed by a licensed geotechnical consulting firm.
1.4 DUTIES OF OWNER’S TESTING AGENCY

A. General: The Testing Agency shall conduct testing and inspection services, interpret them, evaluate the results for compliance with the building permit and the Contract Documents, and report the findings to the Owner’s Representative, A/E, Contractor, and AHJ. Testing and inspection services shall be in accordance with applicable standard methods of ASTM or other standards specified by AHJ, the Contract Documents, and construction industry standards. The Testing Agency shall reasonably support overtime, second shift, and out-of-area activity if requested by the Contractor and approved at the Owner’s sole discretion.

B. Non-Conforming Work: The Owner’s inspectors will document and immediately notify the Contractor and the Owner’s Representative of any Work found defective or not in accordance with the requirements of the Contract Documents.

C. The Owner’s inspectors are not authorized to:
   1. Release, revoke, alter, or enlarge on the requirements of Contract Documents;
   2. Approve or accept any portion of the Work, except as allowed by the special inspection duties delegated by AHJ for building permit inspections and testing;
   3. Perform any duties of the Contractor; or
   4. Stop the Work.

1.5 COSTS

A. The Owner’s Testing Agency and special Inspector costs for initial testing and inspection as specified in the Contract Documents will be paid for by the Owner. Initial tests and inspections are defined as those required to complete the first tests and inspections specified.

B. Additional tests and inspections not specified but requested by the Owner or A/E shall be paid for by the Owner.
   1. However, if the results of such tests and inspections are found to be not in accordance with the Contract Documents, the Contractor will be back-charged for all costs of this testing and inspection as well as re-testing, re-inspection and Owner’s consultants’ services.

C. Costs for additional tests or inspections required because of a Contractor change in products or materials, or source, after a submittal has been reviewed and accepted, shall be borne by the Contractor.

D. Costs of any testing which is required solely for the convenience of the Contractor in its scheduling and performance of the Work shall be borne by the Contractor.

E. Costs for verification testing and inspection of Work done without timely notice, with improper supervision, or contrary to construction practice, shall be borne by the Contractor.

F. Costs for testing of materials for which fabrication and mill reports are required, but not furnished, shall be borne by the Contractor.

G. Costs of any testing which is the responsibility of the Contractor as specified in the Contract Documents shall be borne by the Contractor.

1.6 TESTS AND INSPECTION REPORTS

A. Copies of Test and Inspection Reports: Electronic copies of Owner’s Testing Agency (or other special inspection services) reports and Contractor’s test and inspection reports shall be
exchanged between Owner and Contractor at weekly intervals and shall be provided to AHJ as required. All reports will be signed by a registered engineer. Such reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested and records of special sampling operations that are required shall also be reported.
1. Submit copies of inspection reports, certifications, notices, correspondence, and similar documents and records established in conjunction with building industry standards bearing upon the Work.

1.7 CONTRACTOR’S RESPONSIBILITIES

A. General: Inspection of the Work by the Owner’s special inspectors and/or Testing Agency shall not relieve the Contractor from responsibility for compliance with Contract Documents requirements. Owner’s special inspectors and/or Testing Agency and Owner's Representative shall have authority to reject Work whenever the provisions of the Contract Documents are not being complied with, and the Contractor shall instruct his employees accordingly.

B. Coordination: The Contractor’s shall initiate, coordinate, and conform to the required tests and inspections of AHJ.

C. Access for the Purpose of Inspection: The Contractor shall ensure the Owner’s special inspectors and/or Testing Agency have free access to all parts of the Work and to the shops where the Work is in preparation; are provided proper facilities for safe access for such inspection; and are reasonably furnished equipment, tools, samples, certifications, test reports, design mixes, storage, and assistance as requested by the Owner's Inspector.

D. Storage Facilities: The Contractor shall furnish adequate facilities for the sole use of the Owner’s Testing Agency to provide safe storage and curing space for test specimens that must remain on-site prior to transport to the laboratory.

E. Data: The Contractor shall furnish accepted submittals and approved Change Orders, certificates, and similar data as may be required by Owner’s inspectors to perform their work to assure compliance with the Contract Documents.

F. Notice: Furnish notice to Owner's Representative and coordinate with Owner’s inspectors. Provide a minimum of five (5) working days notice in advance of all required tests and a minimum of forty eight (48) hours in advance of all required inspections, unless otherwise specified.

G. Cancellations: Contractor shall give sufficient advance notice to Owner’s Representative and Inspectors to allow rescheduling of their work load in the event of cancellation or time extension of any scheduled test or inspection.
1. Any charges from an Inspector due to insufficient advance notice of cancellations or time extensions shall be borne by the Contractor, at the Owner's sole discretion.

1.8 TEST FAILURES

A. General: The Owner's Representative may require a re-test of a sampled material when a sample or procedure has failed to pass the required tests. In such cases, two samples shall be tested and the material shall be rejected if either sample fails.
1. In the event any test or inspection indicates failure of a material or procedure to meet the requirements of the Contract Documents, all costs for re-testing or re-inspection shall be borne by the Contractor.
1.9 REPORTING TEST FAILURES

A. General: Immediately upon determination of a test failure, the Owner’s inspector shall telephone the test results to the Owner’s Representative and Contractor. By the end of the following day, the Owner’s inspector shall send written test results to those named on the distribution list.

B. Contractor shall similarly report test failures to Owner’s Representative resulting from work of testing agencies provided by the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. Minimum temporary facilities and controls requirements are specified in this Section. Nothing in this Section is intended to limit the types and amounts of necessary temporary facilities required to perform the Work, and no omission from this Section will be recognized as an indication that a necessary temporary facility is not required for successful completion of the Project, and compliance with the requirements of the Contract Documents and all applicable codes.

B. Included in this Section are the following headings:
   1. Product Delivery, Storage and Handling
   2. Project Site - Work Area
   3. Protection of Existing Utilities
   4. Shutdowns of Existing Equipment and Utility Services
   5. Temporary Support Facilities
   6. Temporary Enclosures and Miscellaneous Construction
   7. Noise and Vibration Control
   8. Construction Parking and Staging
   9. Construction Traffic

C. Owner’s forms referenced in this Section include (see Appendix A):
   1. UW or HMC Utility Shutdown Request form, as appropriate.

D. Behavior:
   1. The Owner will not tolerate inappropriate behavior by any worker on a jobsite toward a student, staff, patient, visitor, neighbor or employee.
   2. The Contractor shall not allow obscene, offensive or otherwise inappropriate material to be displayed at the Project site, or at remote construction staging and parking areas, including job offices and trailers. If such material is displayed, it shall be immediately removed by the Contractor and/or when requested by the Owner’s Representative.
   3. Gratuities to Owner's employees by a Contractor are not allowed per Washington Administrative Code, Chapter 42.52 RCW.

E. Conservation: The Contractor shall install and operate temporary facilities and perform construction activities in a manner which reasonably will be conservative and avoids waste of energy and materials, including water.

F. Pest Control: The Contractor shall rid the Project site of rodents, birds, insects, and other pests which may have entered buildings under construction as a result of the work.

G. Pollution Control: The Contractor shall perform the Work so as to prevent water, soil, and air pollution.
   1. The Contractor shall not discharge volatile, harmful, or dangerous materials into the Owner’s sanitary sewer and storm water drainage systems.
      a. Non-storm water discharge into the Owner’s storm water system is prohibited, including the following types of discharge, unless the stated conditions are met:
         1) Discharges of potable water for, but not limited to, water line flushing, hyper-chlorinated water line flushing, fire hydrant system flushing, and hydrostatic test water must be de-chlorinated to a concentration of 0.1 parts per million or less, pH-adjusted if necessary, and volumetrically and velocity controlled to prevent re-suspension of sediments in the storm water system.
      b. Street sweeping must be performed prior to washing the street at construction sites.
c. All discharges to the sanitary sewer require Owner’s prior approval.

2. The Contractor shall not cause or allow visible emissions of fugitive dust from the construction site, unless reasonable precautions are employed to minimize the emissions. Reasonable precautions include, but are not limited to, the following:
   a. During high winds, the use of control equipment and/or enclosures, the reduction of construction vehicle speeds, and the curtailment of all dust creating construction procedures shall be implemented.
   b. When demolition, excavation, and construction activities generate dust, the construction site shall be sprinkled with water or chemical stabilizers to minimize dispersion.
   c. Truck under-carriages shall be brushed to minimize the transporting of dirt off construction sites.
   d. Truckloads shall be covered, wetted, or allowed adequate freeboard to prevent the escape of dust-bearing materials.

H. Silica Dust Control: The Contractor shall use best engineering and work practice controls to reduce exposure to silica dust at or below the Washington State Permissible Exposure Limit defined in the latest regulations from the Washington State Department of Labor and Industries (L&I), Puget Sound Clean Air Agency (PSCAA) and any other applicable federal, state, and local government regulations.
   1. The Contractor shall assume that silica is present in all concrete, mortar, terrazzo flooring, plaster, sheetrock, fireproofing and other related building products.
   2. The Contractor shall implement controls to contain and clean-up silica dust generated by cutting and demolition work and shall provide worker and equipment decontamination provisions. At no time is silica dust from the construction permitted beyond the “work area.”
      a. The Contractor shall conduct air sampling for respirable crystalline silica in accordance with the National Institute for Occupational Safety and Health (NIOSH) method 7500.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle specified products in accordance with the manufacturer’s recommendations and use means and methods that will prevent damage, including, but not limited to, moisture damage of materials, deterioration, and loss or theft.
   1. Store materials and products off the ground and protect from weather.

B. Furnish products in the manufacturer’s original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

C. Include a waste reduction provision in purchasing agreements requiring that materials and equipment be delivered in packaging made of recyclable material, that the amount of packaging be minimized, and that packaging be taken back for reuse or recycling.
   1. The Contractor shall require the same provisions in its Subcontractor’s purchasing agreements.

D. Inspect products upon delivery to ensure compliance with Contract Documents, and to ensure that products are dry and mold free, undamaged, and properly protected.

E. Store products at the Project site in a manner that will facilitate inspection and measurement of quantity or counting of units.
F. Store heavy products away from the Project structure in a manner that will not endanger the supporting construction.

G. Protect building products subject to damage, under cover in a clean and weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer’s instructions.

H. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
   1. Ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

1.3 PROJECT SITE - WORK AREA

A. Confine operations, equipment, and storage to the designated work area.
   1. Maintain the Project site, including adjacent areas and properties, in a clean and orderly manner free from accumulations of combustible materials and construction waste, including rubbish and debris resulting from construction operations. Clean indoor work areas daily of construction waste, dirt, and dust. Do not store construction materials and equipment in Owner-occupied areas unless approved by the Owner. Immediately clean up any spilled material and/or fugitive construction spoils or debris from adjacent properties and vehicle travel ways. Keep streets, fire lanes, and walks clean and free from obstructions.
   2. Mechanical rooms shall not be used for construction storage, unless approved by Owner.
   3. All masonry cutting is to be done outdoors. Cut stations for all other work shall be located outdoors or within well ventilated dustproof enclosures or other approved containment.

B. Security:
   1. General:
      a. Protect work and stored products from theft and vandalism and protect premises from entry by unauthorized persons. At the end of workday, close temporary enclosures and lock exterior doors and/or gate. Secure all openings at any time the Project site is left unoccupied.
      b. Owner’s Keys: Owner’s Representative will issue keys, as required, for the Contractor to perform the Work. Prior to Substantial Completion, the Contractor will return all issued keys. Contractor’s responsibility shall include, but not be limited to, the following:
         1) Arrange for the issuance of access keys on a daily basis, or as mutually agreed with Owner.
            a) Owner’s costs associated with re-keying a system, including an entire tunnel system, due to lost keys shall be the responsibility of the Contractor.
         2) Lock all access doors when not attended and at the end of each shift.
         3) Provide security barriers, acceptable to Owner, at all utility openings which are created by the removal of gratings and/or the opening of utility tunnels or shafts.
         4) Coordinate Work to minimize need for access to restricted areas.
      c. Many buildings and spaces on Campus are high security areas, such as building mechanical and electrical equipment rooms, certain lab spaces, and computer facilities. Contractor shall use due care to maintain an equivalent level of security of Owner’s property, where appropriate, and as it normally exists (i.e., secure areas when not actively working). Normally locked or closed doors shall not be propped open.
d. Contractor is advised to lock its gang boxes and secure them to the construction. Owner will not reimburse Contractor for any lost or stolen tools, material or equipment.

2. Tunnel System: Owner maintains rigid controls for persons entering the Owner’s tunnel systems. All tunnel doors and certain utility access gratings are equipped with special security locks. The remaining utility access gratings are secured by tack welding.

3. Criminal Background Checks: All construction personnel working in medical centers shall be subject to criminal background checks in accordance with Washington Administrative Code, RCW 43.43.830, et seq.
   a. On the first day of work, each worker shall fill out a Washington State Patrol Request for Criminal History Information form and a Request for Criminal History Record form and submit them to the Contractor’s superintendent who shall submit the collected forms to the Owner’s Representative.
   b. The Owner will request the background check from the Washington State Patrol.
   c. A worker may be conditionally employed on the Project pending results of the criminal background inquiry.
   d. Any worker who does not pass the criminal background check will not be permitted to work on the Project and the Contractor shall immediately remove, or cause the worker to be removed, from the Project.

4. Photo Identification Badges: The Owner requires that all construction personnel working within the Owner’s existing facilities obtain photo identification badges. The badge shall be worn above the waist with the photo visible at all times that the worker is on-site within the Owner’s existing facilities.
   a. On the first day of work, the worker shall complete and submit to the Owner a badge application form(s) provided by the Owner’s Representative, and schedule a time and location with the Owner’s Representative to obtain a badge.
   b. The Contractor shall return the badge to the Owner’s Representative at completion of each worker’s on-site work as a requirement of Final Completion.

C. Construction Waste: Remove construction collected materials from the Project site at a frequency acceptable to the Owner and dispose of in a lawful manner. Do not burn waste material, stockpile waste material, or bury waste material on Owner’s property. Do not use Owner’s waste containers for construction waste of any kind, unless approved by Owner. Dispose of all refuse and waste material, including excess earth from excavation, off of Owner’s property.
   1. See Section 01 74 00 “Construction Waste Management” and, when specified, Section 01 11 01 “Summary of Work – Regulated Materials” for additional requirements.

D. Odor Control:
   1. General: Adjacent Owner areas and/or neighboring buildings may be occupied during construction. The use of solvents and materials producing noxious fumes or any product or equipment that adversely impacts air quality shall be subject to the approval of Owner. Isolate odor-causing work away from building air intakes, private properties and pedestrian traffic areas. Where solvents are used within enclosed structures, vent to outside areas.
   2. Emissions Control Plan: The Contractor shall submit a written procedure for control of emissions prior to any use.
      a. The plan shall at a minimum consist of the following items:
         1) Products to be used/Material Safety Data Sheets
         2) Location of Work
         3) Application
         4) Ventilation plan
         5) Hours of operation
         6) Materials handling/storage
      b. Considerations shall include, but are not limited to:
1) Concrete curing
2) Roofing and waterproofing
3) Welding
4) Exterior painting
5) Adhesive and/or stripping or paint removal
6) Asbestos abatement
7) Soil remediation

3. Equipment and trucks producing fumes shall not be parked or located in the vicinity of building air intakes, entrances, and operable windows, unless approved by the Owner.
   a. Trucks that are idling for more than a few minutes shall shut off their engines. If trucks are queued and idling, there must be at least 20 feet between each truck or the exhaust shall be piped to have a 20-foot separation between each exhaust.
   b. All diesel-powered construction equipment shall utilize ultra-low sulfur diesel fuel.
   c. All diesel-powered construction equipment and trucks must be: 2007 model year or later (for vehicles); or Tier II heavy duty (for stationary engines); or equipped with 3-CARB verified oxidation catalyst-based particulate emissions control devices, operating at 600 degrees F or above.

E. Smoking: The University of Washington and Harborview Medical Center have restricted smoking policies. The Contractor shall not permit its employees or the employees of its Subcontractors of any tier to smoke on the Owner’s property, except in the areas indicated below:
   1. Smoking is permitted on University of Washington campuses where shown on maps: https://www.ehs.washington.edu/system/files/resources/smokingareas_seattle.jpg For the Harborview Medical Center: Contact Owner’s Representative for information.
   2. If the Project site includes a fenced construction area, the Contractor shall establish an outside area, within the fenced area, where its employees and the employees of its Subcontractors may smoke, provided that the area is in compliance with the requirements of Chapter 70.160 RCW. The Contractor shall communicate the location of the permitted smoking area to its employees and Subcontractors, and shall require Subcontractors (of any tier) to communicate the location of the smoking area to its employees.

F. Construction Photographs: Photograph the Project site prior to the start of construction to document original site conditions and provide digital copies of the photographs to Owner. The photographs will be used for determination of the extent of restoration required.

1.4 PROTECTION OF EXISTING UTILITIES

A. The existing concealed utilities shown on the Drawings are not necessarily exact with respect to location or completeness. Therefore, the Contractor shall take the following steps:
   1. Notify Owner in writing, with a minimum two (2) week notice for each occasion, of the intent to work near existing known underground utility services or structures or when a new excavation operation is about to begin. Submit procedure for approval to assure safe and continuous operation of the services.
   2. Proceed with sufficient caution to preclude damaging any known utilities (i.e., hand digging or probing). In the event unidentified utilities are encountered, notify Owner’s Representative immediately.
   3. In the event utilities are damaged during construction, temporary services and/or repairs must be made immediately to maintain continuity of services.
      a. Utilities installed by the Contractor, and damaged by the Contractor, shall be repaired at the Contractor’s sole expense.
1.5 SHUTDOWNS OF EXISTING EQUIPMENT AND UTILITY SERVICES

A. It is generally critical that all building systems remain operational within occupied buildings, except for brief shutdowns that might be required to integrate or connect new Work. Similarly, continuity of equipment and utility services to adjacent buildings and Owner’s site infrastructure shall also be reasonably maintained at all times.

B. Equipment or utility shutdowns required to facilitate the Work shall be accomplished in accordance with the following requirements:
   1. Submit a schedule of equipment and utility shutdowns (see Section 01 32 16 “Construction Progress Schedule”).
   2. Submit a Utility Shutdown Request form to schedule all equipment and utility shutdowns not less than twenty one (21) days prior to the proposed date. Include, as a minimum, the following information:
      a. Equipment or utility services affected
      b. Reason shutdown is required
      c. Work to be accomplished during the shutdown
      d. Proposed date and time
      e. Duration of the shutdown
      f. Proposed method of providing back-up service during shut down
   3. The actual time and date of all shutdowns will be subject to approval of Owner. Shutdowns normally will be scheduled for nights, weekends, school vacations or other low intensity use periods.
   4. The duration of all shutdowns shall be held to a reasonable minimum as determined by Owner.
   5. Materials and equipment required for the Work to be accomplished during shutdown shall be complete and available on the job for review by Owner three days prior to the shutdown, if requested. If Contractor is not adequately prepared, the shutdown will be canceled and rescheduled.
   6. ONLY OWNER’S PERSONNEL WILL SHUT DOWN AND RESTART OWNER’S EQUIPMENT AND UTILITIES. Owner will inspect the installation prior to restarting and will not restart if an unsafe condition exists. In the event Contractor’s Work is not completed during the time scheduled for the shutdown, Owner may elect to restart the equipment or utility service. In that event, additional shutdown requirements shall be rescheduled in accordance with the preceding requirements. Restarting shall not be construed as acceptance of the Work as complete.
   7. Include in the bid all costs associated with equipment and utility shutdowns. Owner will make no extra payment for overtime work, schedule changes or failure to complete utility connections within authorized shutdown periods.

C. For building electrical shutdowns involving de-energization of equipment on the campus high-voltage distribution system, including main breakers for a given building, the following enhancements to the requirements listed above apply. The Owner’s Representative will determine which shutdowns proposed by the Contractor require such enhancement.
   1. A minimum of 6 weeks before the proposed shutdown, the Contractor shall submit a Proposed Shutdown Plan to the Owner’s Representative. This Shutdown Plan shall include the following information:
      a. A description of Contractor tasks and safety measures (such as lock-out/tag-out), necessary to install or otherwise create the project improvements. Include specific names of devices to be switched and a complete list of equipment to be de-energized.
      b. Inspections by the engineer of record, the high voltage shop, and/or the authority having jurisdiction, as applicable. Indicate what inspections are requested and where in the sequence of work they occur.
c. Proposed dates(s) and time(s) with duration(s) of the shutdown. Alternate dates may be proposed but the earliest of the proposed dates shall be no sooner than 6 weeks from the date of submittal of the Shutdown Plan.

d. A draft "UTILITY SHUTDOWN REQUEST" on the standard form in Appendix A.

2. At the Owner’s request, participate in a meeting with the Owner’s Representative and the University’s High Voltage Shop to explain and discuss the Proposed Shutdown Plan. This meeting shall occur at the time of plan submittal or within 2 business days of plan submittal. Insofar as the Shutdown Plan would necessitate tasks to be performed by the High Voltage Shop, the University’s high voltage electricians will use the information as an aid in formulating their approach to the actual switching, and in determining the level of effort and feasibility of the schedule and shutdown in general.

3. At the Owner’s request, check/verify that plans by the University’s zone electricians and others to mitigate building impacts are coordinated with, and safely support, the proposed construction activities.

4. If the Proposed Shutdown Plan is approved or approved with conditions, proceed as follows in paragraph 5. If rejected, work with the Owner’s Representative to reschedule the shutdown.

5. A minimum of 2 weeks before the proposed shutdown, review status with the Owner’s Representative and submit the final UTILITY SHUTDOWN REQUEST. If deemed necessary by the Owner’s Representative, also submit a final Shutdown Plan. These documents shall include, at a minimum, the following information:
   a. The final proposed date, time and duration of the shutdown.
   b. Responses to any conditions imposed on the shutdown by the University’s review and approval process.
   c. Any Contractor-proposed changes to the original (draft) plan.

1.6 TEMPORARY SUPPORT FACILITIES

A. Temporary support facilities include: construction power and lighting and heating and water, toilet and hand washing facilities, mobile communications, cranes and hoists, field offices, and field office communications; and similar miscellaneous facilities (i.e., storage sheds, first aid facilities, clean-up facilities, fire protection, waste disposal) as may be reasonably required for proficient performance of the Work and accommodation of personnel at the Project site, including Owner’s and A/E’s personnel. Locate temporary support facilities for convenience of users, and for minimum interference with construction activities. Placement of all temporary support facilities shall be subject to review and approval by the Owner’s Representative.
   1. Do not block Owner's access to adjoining buildings and occupied spaces through the use of temporary support facilities.
   2. Keep temporary support facilities clean and neat in appearance and do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload temporary facilities or permit them to interfere with progress.
   3. Erection and dismantling of cranes shall occur only on weekends, unless otherwise approved in writing by the Owner.

B. Remove all temporary support facilities including, but not limited to, power and water infrastructure, hoist foundations, and communications cabling and pathway, unless indicated otherwise in the Contract Documents. Restore the Project site to original or new conditions, patching and filling as required to match adjacent surfaces.

C. All connections to Owner utilities must be made in accordance with 1.5 of this Section, “Shutdowns of Existing Equipment and Utility Services.”
   1. Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of the permanent service.
D. Electrical Power and Service: Contractor shall pay for, provide, and install all necessary Owner-approved temporary equipment required for use of the Owner’s electrical power for minor renovations and/or alterations construction work within the Project site of an Owner-occupied facility. Temporary equipment shall be installed and maintained in accordance with all applicable safety regulations and the Owner’s requirements.
   1. Electrical power for the operation of small tools and equipment required for work outside of the Project site will be provided by the Owner as reasonably available from approved existing sources.

E. Lighting: Provide and maintain LED (light-emitting diode) type construction lighting to provide adequate general illumination of the work area and trade task lighting. Shield construction lighting from adjacent residential areas.

F. Heating and Ventilation: Provide temporary heat as required to protect materials and equipment from dampness, cold, and mold growth. Method of heating is subject to approval of Owner’s Representative. Fuel fired “salamander type” heaters are not permitted, unless approved by Owner.
   1. Owner’s HVAC system shall not be utilized for construction in the UW Medical Center. Supply and return-air grills shall be completely sealed-off within the Project site.
   2. New building HVAC systems shall not be operated or used for construction until such time the Contractor has submitted the Contractor’s final punch list report, unless otherwise approved by Owner.
   3. Renovations of Owner’s facilities may utilize existing ducted ventilation supply diffusers but shall not utilize exhaust systems, including return-air grills or fans. Un-ducted plenums over a construction work area must have all ceiling tiles in place, unless otherwise indicated in the Contract Documents or approved by the Owner.
      a. If Owner’s HVAC system is utilized for construction, the Contractor shall:
         1) Protect the HVAC system from construction dust contamination and provide cleaning of the components exposed to contamination prior to Owner’s occupancy.
         2) Install filter media having a minimum efficiency reporting value of 8 (MERV 8) according to the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 52.2-1999 at each supply and return-air grill used during construction.
         3) Replace Owner’s filtration on any return air fan system with a minimum 85% filtration media (as determined by ASHRAE 52.1-1992) prior to Substantial Completion.

G. Water: For construction purposes, will be furnished by Owner.
   1. Contractor shall pay all costs of temporary piping, including pressure reducing station, double backflow preventer, removal of piping and restoration of Owner’s utilities at the completion of the Work. Piping of temporary water service shall not exceed the capacity of the Owner’s system and shall be limited to 1-1/2” pipe size.
   2. Contractor shall provide drinking water from a proven safe source for all those connected with the Work.
      a. The Owner’s “potable” water drinking facilities may be used, if available and approved by Owner.
   3. Contractor shall provide drinking water from a proven safe source for all those connected with the Work.
      a. The Owner’s “potable” water drinking facilities may be used, if available and approved by Owner.

H. Toilet and Hand Washing Facilities:
   1. The Owner’s toilet facilities may be used provided they remain in a clean condition, as approved by Owner.
2. Contractor shall provide alcohol hand sanitizers or hand gel dispensers for workers in medical centers, if restrooms and/or similar hand washing facilities are not available within the Project site.

1.7 TEMPORARY ENCLOSURES AND MISCELLANEOUS CONSTRUCTION

A. Temporary enclosures include, but not by way of limitation, fire-rated barriers, dustproof enclosures, and site fences to protect the Work and to provide for public protection as required by law and ordinance.

1. Provide one-hour fire-rated barriers of gypsum sheetrock and metal studs with taped joints where shown on the Drawings or when removing and/or compromising existing fire safety partitions indicated on the Drawings, such as corridor walls and/or occupancy separations, to completely isolate the construction area from other occupied building areas. Remove and repair finishes to match existing at completion of Work.
   a. Fire Safety during construction, alteration, or demolition must be provided as indicated by the current edition of the International Fire Code with local amendments and applicable rules. Combustible materials are not permitted to be used as barriers.

2. Provide dustproof enclosures within occupied buildings to enclose the entire work area and completely isolate it from surrounding areas, unless otherwise approved by Owner. At a minimum, construct dustproof enclosures on metal studs from one layer of: 5/8 inch gypsum sheetrock; 1/4 inch fire retardant low VOC (volatile organic compounds) shiny surface materials (such as melamine); 6-mil fire retardant plastic sheathing; or 4-mil fire retardant polypropylene. Tape all joints smoke tight and continuously seal all connection points to existing construction utilizing painters tape for existing surfaces to be retained, melamine tape for melamine enclosures, and duct tape for existing surfaces not to be retained. Enclosures must extend above ceilings to the structure above except when the entire work area ceiling is completely sealed from the above ceiling space, in which case, the seal may occur at the ceiling. If the Contractor employs a combination of temporary enclosures and existing construction to enclose the work area, the Contractor shall seal any penetrations found in the existing construction, including supply and exhaust HVAC duct grills that shall be blocked off and sealed shut.
   a. All existing finishes damaged by construction are to be repaired to their original condition and ceiling tiles damaged by the Contractor are to be replaced with equivalent undamaged tiles at completion of the Work.
   b. An Owner-approved portable mini-enclosure shall be utilized outside the containment area for ceiling work: that will be completed within one shift; with limited dust disturbance/creation; with little anticipated noise; and with no “hot work.”
      1) Portable mini-enclosures shall be constructed of 6-mil fire-retardant plastic sheathing with zipper openings. Completely seal all joints and connection points with smooth vinyl tape. All ceiling tiles removed by Contractor must be placed back into position before the mini-enclosure is removed.

3. Fire barrier and/or dustproof enclosure doors are to be installed in rigid frames and be self-closing and fitted with a gasket or other material to restrict closing noise and inhibit airflow, except for plastic sheathing enclosures which shall have zipper wall doors for personnel access. The door and its frame shall be painted in medical centers.
   a. All interior Project site entrances and exits shall have dust containment walk-off mats (sticky mats) present at all times. Provide 24” x 36” minimum size with layers to be peeled off when fully loaded. Secure mats to floor and install snug to enclosure entrances.
      1) Mats must be clean, intact and maintained on a constant basis. Avoid locating adhesive walk-off mats in public walking areas and patient transport areas in medical centers.

4. All elevator openings within the work area of occupied buildings, except working construction elevators, shall be sealed airtight from the work area.
5. Site Fences: Provide temporary six (6) foot high chain link fence panels with top rail fastened to tubular metal posts set in heavy concrete bases to prevent ready relocation, unless otherwise indicated, to enclose exterior areas of the Project site and off-site lay-down and Contractor parking areas provided by the Owner. Panels are to be anchored together to prevent entry between panels. Provide gates or equal to facilitate access to fire hydrants, pumper connections and standpipes. No barbwire is permitted.

B. Provide miscellaneous construction to protect the Work. Furnish, install, and maintain for the duration of construction all required tarpaulins, barricades, security barriers, canopies, warning signs, steps, bridges, platforms and other temporary construction necessary for the safe and proper completion of the Work. Maintain the temporary construction in compliance with all pertinent safety and other regulations. Temporary barricades that obstruct exit paths from occupied areas shall not be installed unless approved by Owner.
   1. Egress Signage: Provide and install temporary exit signs, as needed, to insure a clear direction or emergency exit travel in occupied areas adjacent to the construction project. Review the temporary exiting routes and signage design and location with Owner’s Representative.
   2. Other Signage: Provide informational signs, warning signs, and any other sign required by AHJ for the Project.

1.8 NOISE AND VIBRATION CONTROL

A. Construction shall not exceed the maximum permissible sound levels defined by the local AHJ and shall meet the special conditions of the Project.

B. Exterior Construction Noise: Maintain the sound pressure level of exterior construction noise from exceeding decibels with a frequency rating function A (60 dBA) inside adjacent facilities with windows closed between the hours of 8:00 a.m. and 5:00 p.m. weekdays.
   1. If required, the Contractor shall meet this criterion by erecting barriers between work equipment and adjacent facilities.

C. Limited Hours of Use Within Buildings: Noise-producing equipment exceeding 60 dB(A) and/or vibration-producing equipment is subject to approval of Owner and in general will be allowed only before 7 a.m. and after 6 p.m. except within medical centers where use will be allowed from 8 a.m. - 7 p.m., unless otherwise approved by the Owner.
   1. When possible, combine noisy and vibration-producing operations into one time period.
   2. Specific scheduling is required for Work within the UWMC, HMC and the UW Health Sciences Center. Contractor shall provide its work schedule to Owner for approval no later than three (3) weeks prior to commencing any noisy and/or vibration-producing work.

D. Noise and Vibration Control Plan: Contractor shall submit a written procedure to minimize construction vibration and noise prior to performing physical impacts to, or demolitions of, existing structural components.

E. Machinery & Equipment: Equipment shall be as quiet as feasible for the work being performed. Electric-driven or hydraulically drawn is preferred to gas, diesel, or pneumatic powered machinery. If noise levels on any gear cannot meet the criteria of this Section, either that gear will not be allowed on the job or use times will have to be scheduled subject to approval of the Owner. Conformance to this requirement shall be included in the Contract price and no compensation will be allowed for special equipment or overtime that may be required.
   1. Construction personnel shall limit the extent of unnecessary equipment idling.
F. Outdoor Vehicle and Internal Combustion Engine Noise: In addition to the requirements applicable to exterior construction noise in this Section, the sound pressure level of each piece of equipment shall not be greater than 85 dBA when measured at the property line of adjacent real property of another person, and when measured at a distance of 50 feet from the emission source under noisiest operating conditions.
   1. Rubber-tired equipment shall be used whenever possible instead of equipment with metal tracks.
   2. When required, mufflers for stationary engines shall be "hospital-area" quality of silencing.
      a. Contractor is to routinely verify equipment mufflers and/or noise barriers are intact and operational.

G. Air Compressors: Equip air compressors with silencing packages--electric-driven preferred.

H. Arc Welders: No arc welders are to be connected to Owner's utilities, unless approved by the Owner. Provide separate gas generators for arc welders.

I. Jack Hammers and Rotary Hammer Drills: May be used where no other alternative is available, if permitted by the Owner. The use of core-drilling and saw cutting equipment, or electric driven drills is preferred. Time of use is subject to approval by Owner.

1.9 CONSTRUCTION PARKING AND STAGING:

A. Parking permits are required for all vehicles parking on campus. Parking without a valid parking permit will result in citation and possible impound of vehicle.
   1. Parking on or near University of Washington and Harborview Medical Center campuses is congested. To minimize disruptions to campus operations and the impact on the adjacent neighborhoods, Contractor shall limit the number of vehicle trips to the Project site and encourage carpooling. In addition, the Contractor shall advise construction workers not to park on city streets and in neighboring residential areas.
      a. Parking on the University of Washington campus, outside a fenced Project site, is not available or permitted for Contractor and Subcontractor vehicles on the dates of graduation, convocation, and on Husky football game days.
      b. This information shall be posted at the Project site along with bus pass/ticket information.
   2. The Contractor is responsible for advising all parties on the Project of their designated parking area and ensuring that all workers park there. If parking needs change for any reason, Contractor shall advise the Owner’s Representative so, to the extent possible, necessary accommodations can be made.
   3. A designated parking area, outside the Project site, is for workers' personal vehicles only and not for the storage of construction equipment or materials.

B. The Contractor shall limit construction parking to area(s) indicated in the Contract Documents.
   1. Daily construction parking is available for purchase at the E-1 and E-4 parking lots.
   2. Parking permits for construction parking within a staging lay-down area or within a temporary parking area with site fencing will be issued at no cost to the Contractor. Specific responsibilities include:
      a. Contractor shall provide Owner's Representative with the projected number of permits required two weeks prior to the month required.
      b. Owner's Representative will provide to Contractor the requested number of monthly parking permits no later than the 25th day of the preceding month prior to the month for which permits are to be used.
C. There is generally no staging area available at the University of Washington Medical Center and Health Sciences Center areas. Only limited loading and unloading of tools and material will be allowed at the loading docks and for restricted time limits.

D. For Seattle campus parking and traffic regulations and parking rates, visit: http://www.washington.edu/facilities/transportation/

1.10 CONSTRUCTION TRAFFIC

A. The Contractor and the Contractor’s Subcontractors and suppliers shall minimize negative traffic impacts on city streets for construction. Scheduled truck traffic shall avoid the peak hours of 7:00 – 9:00 AM and 3:00 – 6:00 PM, Monday through Friday.

B. Deliveries on the Seattle campus: If a Contractor, Subcontractor, or supplier needs to make a delivery, the driver must stop at a Campus gatehouse upon entry during the posted hours of operation for UW Parking Services and obtain a commercial delivery permit.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the administrative and procedural requirements for field engineering, in addition to requirements specified elsewhere in the Contract Documents, requiring the Contractor to employ a registered “Structural Engineer” and/or “Land Surveyor.”

B. Related Sections:
   1. Section 01 73 29 “Cutting and Patching”

1.2 QUALITY ASSURANCE

A. Contractor shall employ a registered Structural Engineer (Contractor’s Structural Engineer) experienced in construction techniques and sequences, and temporary structural support systems, who is licensed in the State of Washington.

B. The Contractor shall employ a registered Land Surveyor (Contractor's Surveyor) who is registered in the State of Washington, and acceptable to Owner, to perform survey work of this Section.

C. Submit the name, address, and telephone numbers of the Contractor’s Structural Engineer and Land Surveyor for Owner’s records, prior to their performance of Work.

1.3 CONTRACTOR’S STRUCTURAL ENGINEER

A. The Contractor’s Structural Engineer shall advise the Contractor as to the safety and adequacy of all temporary structural provisions necessary for cranes and hoisting, erection and/or alteration of the building structure and shall assume the responsibilities and duties as it relates to means and methods for these items (e.g., erection sequence, temporary bracing, cutting).
   1. Temporary bracing shall be coordinated with other trades to permit continuous operation of construction.
   2. Should it be necessary to modify the structural design to accommodate construction means and methods, the Structural Engineer shall advise the Contractor who shall immediately notify the A/E and await his/her direction.
   3. Proposed changes or modifications to the structural design shall be submitted to the A/E for approval prior to the Contractor incorporating changes or modifications into the Work.

1.4 OWNER’S PROPERTY SURVEY

A. Owner’s property survey for the Project is included in the Contract Documents.

B. The Owner will provide the services of a public land surveyor to locate the property corners noted on the Contract Documents and establish benchmarks for use by the Contractor.

1.5 PROJECT SURVEY REQUIREMENTS

A. Before proceeding with layout of actual work, the Contractor, working through the Contractor’s Surveyor, shall verify the layout information shown on Contract Documents and the Owner’s property survey.
B. As work proceeds, the Contractor shall check every major element for line, level and plumb, and shall require the Contractor's Surveyor to maintain a complete and accurate record book log of control of such checks and upon request shall make this log of control available for the Owner's and A/E's reference.
   1. Record deviations from required lines and levels and promptly advise the Owner's Representative upon detection of any discrepancies including, but not limited to, conflicts, errors, inconsistencies, or deviations that exceed the Contract specified or indicated or industry recognized tolerances.
   2. If discrepancies are found, no work shall be done until the Owner's Representative has been so notified and has provided the Contractor with written direction and/or drawings which correct and clarify the discrepancy.
   3. All work which is determined to be incorrectly located will be rejected by the Owner. Any additional corrective work caused by discrepancies that should reasonably have been known to the Contractor and were not called to the attention of the Owner's Representative, shall be borne at the Contractor's expense.

C. Protect Owner's benchmarks and survey control points prior to starting site work and preserve during construction. Do not change or relocate benchmarks or control points without Owner's written approval. Promptly report lost or destroyed benchmarks or control points.

1.6 PROJECT RECORD SURVEY

A. Contractor working through the Contractor's Surveyor shall perform the following:
   1. Upon completion of new foundation walls, prepare and submit a certified survey showing that dimensions, elevations, angles, and location of the building are in accordance with the Contract Documents.
   2. Upon completion of the below grade site work, certify that the Project Record site survey represents the actual dimensions, elevations, lines, grades, and levels, including invert elevations, constructed in the field for all below grade installations and existing services located during the Work referenced to Owner's benchmarks. This shall include the locations of all below grade site improvements including, but not be limited to, civil, electrical and mechanical services, utility tunnels, duct banks and vaults, and irrigation system.
   3. The above documentation shall be submitted to the Owner under provisions of Section 01 77 00 for CAD As-built Shop Drawings.

1.7 PROJECT LAYOUT REQUIREMENTS

A. The Contractor shall be responsible for laying out the Work utilizing recognized engineering survey practices. Establish elevations, grades, lines and levels for:
   1. Site improvements, including pavements, walks and retaining walls, stakes for grading, fill and topsoil placement, utility locations including slopes and invert elevations, and irrigation system.
   2. Grid and axis of building structures.
   3. Building foundations, column locations, ground floor elevations, elevations and levelness for floors and roofs.
   4. Other elevations, grades, lines and levels, as needed to properly locate each element of the Project.

B. Calculate and measure required dimensions as shown within recognized tolerances. Do not scale drawings to determine dimensions.

C. Advise entities performing work of marked elevations, grades, lines and levels, provided for their use.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the administrative and procedural requirements for cutting and patching and general alterations of the Project including, but not limited to, preparations, products, transitions and adjustments, and repairs and disposal.

B. Related Sections:
   1. 01 11 01 “Summary of Work – Regulated Materials”
   2. 01 35 23 “Owner’s Safety Requirements”
   3. 01 71 23 “Field Engineering”

1.2 CONTRACTOR RESPONSIBILITY

A. The Contractor shall bear all cost of correcting damaged or destroyed work, indicated to remain on the Contract Documents, which is caused from failure to comply with the requirements of the Contract Documents or failure to exercise reasonable care by the Contractor and/or the Subcontractors’ work.

1.3 SUBMITTALS

A. Notice:
   1. Submit written request two (2) weeks in advance of cutting or alteration which affects:
      a. Structural integrity of any element of the Project;
      b. Integrity of weather-exposed or moisture-resistant elements;
      c. Efficiency, maintenance, or safety of any operational element;
      d. Visual qualities of sight exposed elements; and
      e. Work of Owner or separate contractor.
   2. Include in request:
      a. Project name
      b. Location and description of affected work
      c. Description of proposed work
      d. Reason for cutting or alteration
      e. Alternatives to cutting and patching
      f. Effect on work of Owner or separate contractor
      g. Written permission to affect separate contractor
      h. Date and time work will be executed, including duration of work
      i. Utility Shutdown Request form, as appropriate
   3. Owner will respond in writing to the submitted request.

B. Visual Matching: When indicated to “match existing,” submit products and/or finishes to match existing adjacent finishes for Owner’s review and approval or, for patching new work, use the specified materials and finishes in the Contract Documents.

PART 2 - PRODUCTS

2.1 PATCHING AND EXTENDING WORK

A. The Contractor shall provide products specified in the Contract Documents and/or match existing products with an alternate product of the most suitable grade for the intended purpose.
B. The Contractor shall determine the type and quality of existing products and finishes by inspection and/or testing, where necessary.
   1. Remove samples of existing installed work for testing only when approved by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencing work:
   1. The Contractor shall inspect existing conditions to ascertain elements subject to damage or movement and to determine the need for temporary bracing during cutting and patching work; and
   2. Verify that materials to be worked-on or removed have been evaluated in the Owner’s Regulated Materials “Good Faith” Survey report.

B. Beginning of cutting or patching means acceptance of existing conditions.

C. After cutting and/or removing existing work:
   1. The Contractor shall inspect conditions affecting performance of new work and notify Owner of any unforeseen physical conditions; and
   2. Verify that demolition is complete and areas are ready for installation of new work.

3.2 PREPARATION

A. Move, or remove, items as necessary for access to cutting and patching work.

B. For Owner occupied facilities, prepare a noise and vibration control plan in accordance with Section 01 50 00 “Temporary Facilities and Controls.”

C. Schedule shut-downs and obtain permits required for performance of the Work.

D. Provide temporary supports to ensure structural integrity of the Work.

E. Provide temporary enclosures, shielding devices and/or other methods to protect the following from damage:
   1. Existing conditions that are to remain
   2. Owner occupied areas
   3. Owner’s building systems, including HVAC systems

F. Establish “hot-works” fire safety precautions required for performance of the Work.

3.3 PERFORMANCE

A. Execute cutting and patching work in a manner to:
   1. Avoid damage to other work;
   2. Provide proper surfaces for installation of new work; and
   3. Provide a neat transition from existing finishes to new work.
      a. Fit new work to existing pipes, sleeves, ducts, conduit and other penetrations through surface

B. For all new work made to existing work under warranty, employ original installer or fabricator to perform cutting and patching unless otherwise approved by the Owner.
C. For additional cutting and patching requirements in medical centers, see Section 01 35 33 “Infection Control.”

D. Prepare surfaces to provide for the specified installation of new work and finishes.
   1. Remove and replace or repair unsuitable substrate materials (e.g., rotted wood, water damaged materials, corroded metals and deteriorated concrete) for new applications.

E. Restore existing building systems that are impacted by cutting and patching work to original operating conditions.

F. For penetrations cut in existing fire-rated separations, completely seal new work with fire-stopping materials to full thickness of the penetrated element.
   1. Replace existing fire-stopping materials when disturbed by new work.

G. Unless otherwise indicated in the Contract Documents, cut concrete and masonry materials using a diamond saw in accurately located straight lines. Pneumatic tools are not allowed without Owner’s prior approval.
   1. Concrete walls: Core drill pipe penetrations. Saw both sides of wall and break out remainder. Minimize overcuts.
   2. Concrete floors: Provide temporary support of elevated floor areas requiring removal and saw-cut. Core-drill pipe penetrations.
   3. Masonry walls: Saw-cut along mortar joints. Remove all mortar adhering to edges. Overcuts are not allowed.
   4. Wood and/or metal frames walls: Cut wall finish materials in straight uniform lines and remove wall framing as required.

H. Remove debris and abandoned items from the work area, including from concealed spaces.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This section includes administrative and procedural requirements for construction waste management activities.

B. Related Sections:
   1. 01 50 00 “Temporary Facilities and Controls”

1.2 GOALS AND PROCEDURES

A. The Owner has established waste management goals for this Project with the minimum requirement of diverting 50% of non-hazardous and non-regulated construction and demolition waste, including recycled or donated materials, by weight in tons, from landfill disposal and/or incinerator.
   1. For materials which contain lead or have lead-containing coatings, see Section 01 11 01 “Summary of Work – Regulated Materials.”

B. Waste classified as hazardous materials or dangerous waste will be disposed of by the Owner (see Section 01 11 01 “Summary of Work – Regulated Materials,” if applicable).
   1. If the Contractor suspects that an unidentified hazardous or dangerous material may exist in the Project area, the Contractor shall inform the Owner of this possibility. Owner will investigate and test the material to determine the extent and nature of the material and to decide on appropriate procedures.

1.3 CONTRACTOR RESPONSIBILITY

A. To the maximum extent possible, the Contractor shall separate recyclable materials from construction, demolition, and land clearing waste to be disposed of as garbage.

B. The Contractor shall designate an on-site construction “waste management coordinator” responsible for instructing the Contractor’s workers and Subcontractors in the requirements of the construction waste management plan and for overseeing and documenting results.
   1. When on-site dumpsters and recycling bins are required by the Contract Documents, the waste management coordinator shall conduct regular visual inspections of dumpsters and recycling bins to ensure materials are being separated properly and to remove contaminants.

1.4 DEFINITIONS

A. Construction, Demolition, and Land Clearing (CDL) Waste: Includes all non-hazardous solid wastes including material that is recycled, reused, salvaged, and/or disposed of as garbage.

B. Salvage: Recovery of materials for reuse.

C. Reuse: Making use of a material without altering its form for reuse on-site or reuse on other projects off-site (e.g., grinding of concrete for use as sub-base material and chipping of land clearing debris for use as mulch).

D. Recycling: The process of sorting, cleaning, treating, and reconstituting materials for use in the manufacture of a new product.
E. Source-Separated CDL Recycling: The process of providing on-site separation of recyclable materials into separate containers as they are generated. The separated materials are hauled directly to a recycling facility or a transfer station.

F. Co-mingled CDL Recycling: The collection of mixed recyclable materials in one on-site container. The container is taken to a material recovery facility where materials are separated for recycling.

G. Material Recovery Facility (MRF): A facility used to sort and recover CDL waste materials for recycling.

H. Transfer Station: A facility where waste is moved from collection vehicles to larger trucks for longer distance transport to a landfill, source-separated recycling facilities, or MRF.

I. Approved Recycling Facility: A facility that can legally accept CDL waste materials for the purpose of recycling into a new product where the method of recording and calculating the recycling rate is regulated by local or state government.

1.5 PERFORMANCE REQUIREMENTS

A. General: Divert CDL waste from landfills by one, or by a combination, of the following activities:
   1. Salvage
   2. Reuse
   3. Source-separated CDL recycling
   4. Co-mingled CDL recycling

B. CDL waste materials to be salvaged, reused, or recycled include, but are not limited to, the following:
   1. Acoustical ceiling tiles
   2. Asphalt
   3. Asphalt shingles
   4. Brick
   5. Cardboard
   6. Carpet and pad
   7. Concrete
   8. Drywall
   9. Insulation
   10. Metals
   11. Paint
   12. Porcelain
   13. Wood
   14. Plastic film such as sheeting, shrink wrap, and packaging
   15. Window glass
   16. Field office waste such as paper, aluminum cans, glass, plastic, and office cardboard

1.6 CONSTRUCTION WASTE MANAGEMENT (CWM) PLAN

A. Prior to performing any on-site work, the Contractor shall develop and submit a CWM plan for Owner’s review and comment. The CWM plan shall include a reuse and salvage plan, identification of waste types by quantity and weight in tons, methods of disposal, and handling and transportation procedures. Include separate sections in plan for construction demolition, land clearing debris and construction waste.

B. The reuse and salvage plan shall include:
1. A list of items being reused in place or elsewhere on the Project;
2. A list of items for reuse off-site through salvage, resale or donation; and
3. A plan for protecting, dismantling, handling, storing and transporting the reused items.

C. The Contractor shall organize the CWM plan to include the following information:
1. Types and estimated quantities, by weight in tons, of CDL waste expected to be generated during demolition and construction.
2. Proposed methods for CDL waste salvage or reuse during demolition including, but not limited to, one or more of the following:
   a. Contracting with a deconstruction specialist to salvage materials
   b. Selective salvage as part of the demolition Subcontractor’s work
   c. Reuse of materials on-site, or sale or donation to a third party for reuse
3. For this Project, there is no on-site space available for source-separated CDL recycling and waste collection. The Contractor shall contract with a recycling hauler, who accepts commingled construction and demolition debris, for hauling to an approved MRF.
4. Name of recycling facility or MRF receiving the CDL wastes.
5. On-site Handling Plan: Proposed locations for collecting CDL waste and/or separating recyclable waste into containers including, but not limited to, types and sizes of containers, and frequency of removal.
6. CWM Communication Procedures: Describe how the CWM plan will be communicated to the Contractor’s workers and the Contractor’s Subcontractor’s workers (of any tier).

1.7 CONSTRUCTION WASTE MANAGEMENT (CWM) REPORT

A. CWM Report: The Contractor shall submit a cumulative CWM report on an Owner-approved form as a requirement of Final Completion with the following attachments:
1. A record of the type and quantity, by weight in tons, of each material salvaged, reused, recycled or disposed of
   a. Dirt and land debris must be documented separately
2. Total quantity of waste recycled as a percentage of total waste
3. Disposal Receipts: Copy of receipts issued by a disposal facility for CDL waste that is disposed in a landfill
4. Recycling Receipts: Copy of receipts issued by an approved recycling facility
   a. For co-mingled materials, include weight tickets from the recycling hauler or MRF and verification of the recycling rate for co-mingled loads at the facility.
5. Salvaged Materials Documentation: Types and quantities, by weight, for materials salvaged for reuse on-site, or sold or donated to a third party

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT MEETING

A. The Contractor shall schedule and administer a construction waste management meeting prior to construction activities and shall record and distribute copies of meeting minutes to all attendees (The Contractor may conduct this meeting as part of the first pre-installation meeting).
1. Attendees:
   a. Owner’s Representative
   b. A/E
   c. Contractor’s superintendent and waste management coordinator
   d. Major Subcontractors
   e. Business and Industry Resource Venture representation, as appropriate
2. Agenda Items: Review methods and procedures related to waste management including, but not limited to the following:
   a. Review and discuss CWM plan, including identification of and responsibilities of the Contractor’s waste management coordinator
   b. Review requirements for documenting quantities of each type of waste and its disposition.
   c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays
   d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   e. Review waste management requirements for each trade.

3.2 SOURCE-SEPARATED CDL RECYCLING

A. Provide containers for separating CDL waste that is to be recycled, clearly labeled with a list of acceptable and unacceptable materials.

B. For managing on-site stockpiled recyclable materials until removed, stockpile without intermixing with other materials, place and shape to drain surface water, and cover to prevent windblown dust.
   1. Stockpile materials away from demolition areas. Do not store within drip line of existing trees.

3.3 CO-MINGLED CDL RECYCLING

A. Do not put CDL waste that will be disposed of in a landfill into a co-mingled CDL waste recycling container.

3.4 LANDFILL AND/OR INCINERATOR WASTE

A. Provide containers for CDL waste that is to be disposed of in a landfill or by incineration, clearly labeled as such.

3.5 REMOVAL OF CONSTRUCTION WASTE MATERIALS

A. Transport CDL waste materials off Owner’s property and legally dispose of them.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies minimum administrative and procedural requirements for mechanical and electrical systems functional performance testing required by the Contract Documents.

B. Related Sections:
   1. 01 91 00 “General Commissioning Requirements”

1.2 SERVICES

A. Test Engineer - provided by Contractor.

B. Commissioning Authority - provided by Owner.

C. Electrical Testing Contractor (ETC) - provided by Electrical Subcontractor (working through the Contractor’s Test Engineer).

D. Testing, Adjusting and Balancing (TAB) - provided by Owner.

1.3 REQUIREMENTS FOR TEST ENGINEER

A. The Contractor shall provide the services of a “Test Engineer” experienced in commissioning including the troubleshooting of equipment and systems. The Test Engineer shall be qualified to develop and write, coordinate and schedule, and manage and document mechanical systems functional performance tests (FPT). The Test Engineer shall also coordinate the work of the ETC and assemble the required electrical commissioning documentation.

1.  Qualified personnel experienced in the technical aspects of each system to be commissioned shall be provided, if necessary, to augment the expertise of the Test Engineer.

1.4 TEST ENGINEER DUTIES

A. The Test Engineer shall prepare and submit all FPT and commissioning documentation required by the Contract Documents for the actual equipment and systems installed, including but not limited to, start-up plans, installation verification audit reports, start-up and FPT deficiency report forms, test equipment identification lists, FPT procedures, FPT data forms, and one-line system and riser diagrams.

1. Maintain separate mechanical and electrical (M&E) systems “Commissioning Binders,” indexed and tabbed according to the equipment or systems requiring commissioning, to compile the start-up and FPT documentation. Blank start-up forms, approved by the Commissioning Authority, shall populate the initial binders and be replaced with completed forms that shall be submitted in final M&E systems Commissioning Binders, as a requirement of Final Completion. The binders shall be on-site during the work (see Section 01 91 00 for the Commissioning Binders documentation requirements).

2. Prior to testing, the Test Engineer shall have applicable Subcontractor’s and manufacturer’s representatives review the test and commissioning documentation to identify personnel safety issues, equipment protection issues, and to validate relevance to the actual equipment provided.
B. Prepare and submit a “Commissioning Plan” for Owner’s review and comment before developing the FPT procedures and prior to any equipment or systems testing and/or start-up required by the Contract Documents.

C. Develop a commissioning schedule for all FPT and commissioning activities required by the Contract Documents and integrate into the construction Progress Schedule. Identify:
1. Commissioning Plan preparation, submittal, and review;
2. Each required functional performance test;
3. Sequence of testing, including commissioning activity start-up prerequisites, point-to-point testing, and balancing activities; and
4. Submission and approval of test results.

D. Develop and write FPT procedures for all equipment tests, and systems and cross-systems tests required by the Contract Documents. Test procedures shall be in accordance with equipment manufacturer's recommendations, where applicable. Test procedures shall fully describe the equipment or system configuration and steps required for each test. The procedures shall be appropriately documented so that another party can repeat the identical test.
1. Maintain a set of drawings for recording the sign-off of each component of the plumbing and piping system pressure testing, heating, ventilation, and air conditioning (HVAC) system duct work pressure testing, and the completed flushing/cleaning and treatment activities.

E. Coordinate the participation of each Subcontractor, including the ETC, specific to their start-up and testing responsibilities. Inform each Subcontractor as to what their test and expected results will be prior to commissioning.

F. Observe the progress of the work to assure that all installations requiring commissioning are being made in accordance with the Contract Documents. Prepare and submit installation verification audit reports prior to the start-up of equipment or systems for which a formal start-up is specified in the Contract Documents.

G. Coordinate all cross-systems testing such as HVAC, environmental controls, fire alarm, emergency power, life safety, elevators, and chiller controls.

H. Manage and observe the start-up testing and all final tests of equipment and systems required by the commissioning plan and document test results.

I. Report any deficiency in equipment or systems and either enforce compliance with the Contract Documents or provide Owner with technical expertise to recommend modifications to the equipment or systems to correct the deficiency. Oversee and direct the correction of deficiencies found during commissioning.

J. Coordinate the required Commissioning Authority, A/E or other Owner-witness participant for all test/approval procedures, after verifying that pretests have been satisfactorily conducted and final tests are ready to be performed.
1. Notify the Owner's Representative in writing of the date, time, location, and anticipated duration of start-up and test activities, with a minimum of five (5) working days advance notice.
2. Obtain the signature of the designated witness on all data forms. If the witness is unavailable at the scheduled time and location of the activity, so note, and proceed per schedule without the witness.
K. Compare operation and maintenance information provided by the various Subcontractors and vendors with the Project Record documents and report any discrepancies to the Owner's Representative.

L. Oversee and provide Owner with operating instruction and training for the mechanical and electrical equipment and systems specified in the Contract Documents, with coordination by the M&E Subcontractors.

M. Provide as-built information to update the commissioning basis-of-design criteria.

1.5 TEST FAILURES

A. In the event that a functional test fails, the Contractor shall determine the cause of failure, rectify the failure as soon as possible, and then retest. If more than two (2) functional tests of the same system are required, all costs for additional testing shall be borne by the Contractor, at the Owner's sole discretion.

1.6 CANCELLATIONS

A. The Test Engineer shall give at least 48 hours advance notice to the Owner's Representative of cancellation of any scheduled test.

1. Any costs incurred by Owner due to insufficient advance notice of cancellations shall be borne by the Contractor, at the Owner's sole discretion.

1.7 WARRANTY TESTS

A. In the event a product fails during the warranty period, the Contractor shall determine the cause of failure, rectify the failure as soon as possible, and then retest. All warranty testing shall be borne by the Contractor.

1.8 TEST ENGINEER QUALIFICATIONS

A. The Contractor shall propose a Test Engineer, who is competent in the Project's M&E systems design and intent, for the Owner to evaluate and approve or reject in writing, based upon the following criteria which shall be documented in the Test Engineer resume.

1. The Test Engineer shall have extensive experience in start-up and troubleshooting of HVAC, hot water heating, chilled water, steam, plumbing, electrical, emergency power, fire alarm, lighting controls, life safety systems and other systems of similar complexity to those contained in the Contract Documents that are required to be commissioned.

2. The Test Engineer shall:
   a. Be familiar with the Project's control operating system(s);
   b. Be capable of troubleshooting control code and recommending necessary modifications;
   c. Be knowledgeable in testing and balancing of both air and hydronic systems;
   d. Have an excellent working knowledge of complex fire alarm, environmental and electric power control systems;
   e. Have excellent communication and writing skills, be highly organized, and be able to work well with the Project's Subcontractors; and
   f. Have a Bachelor's degree in mechanical engineering, PE certifications, and related field experience.

   1) However, in lieu of a Bachelor's degree and PE certifications, other technical training with extensive practical field experience may be considered.

B. Test Engineer Resume - The Contractor shall submit the Test Engineer's resume, including the following documentation:
1. Present or most recent employment:
   a. Company name and address
   b. Present title and job description
   c. Dates of employment
2. Other relevant work experience:
   a. Company name and address
   b. Job title and description
   c. Dates of employment
3. For a minimum of three (3) similar projects, description of commissioning experience and roles performed in commissioning activities that demonstrate working knowledge of complex systems.
4. Samples of a commissioning plan, a start-up plan, and a FPT with data forms written by the Test Engineer.
5. References from a minimum of three (3) project owners and/or commissioning authorities.
6. Description of education, certifications, and other technical training or field experience.

1.9 COMMISSIONING AUTHORITY

A. The Owner will provide a “Commissioning Authority,” or appoint an Owner-designated witness, to act as the commissioning authority.
   1. The Commissioning Authority will provide no labor or equipment in the commissioning process.

B. The duties of the Commissioning Authority are to:
   1. Provide commissioning basis-of-design criteria, for Contractor’s information;
   2. Ascertaining that the Project commissioning processes and information provided is in accordance with the requirements of the Contract Documents;
   3. Review the Contractor’s Commissioning Plan, start-up plans, installation verification audit reports, start-up and FPT deficiency report forms, and FPT data forms;
   4. Review the Contractor’s equipment, systems and cross-systems FPT procedures;
   5. Witness, verify, and approve satisfactory completion of equipment, systems and cross-systems FPT, based upon the Contract Documents requirements;
   6. Review for accuracy, comment on, and approve specified close-out documentation;
   7. Recommend Substantial Completion when commissioning and training has been successfully completed; and
   8. Provide final commissioning reports to the Owner.

C. The Commissioning Authority will communicate as follows:
   1. The Commissioning Authority will formally communicate with the Contractor via approved project channels. It is expected, however, that informal communication and coordination will be conducted directly with the Test Engineer. As the Owner’s commissioning representative, it is expected that the Commissioning Authority will communicate directly with A/E, as may be appropriate.
   2. The Commissioning Authority will keep the Owner’s Representative advised regarding commissioning activities and progress, equipment and systems performance, and any problems and solutions thereto.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for Contract closeout including, but not limited to:
   1. Project Record
   2. Operation and Maintenance Manuals
   3. Warranties and Bonds Manual
   4. Operating Instructions and Training
   5. Cleaning
   6. Owner’s Final Inspection
   7. Substantial Completion
   8. Final Completion, and
   9. Final Acceptance

B. For additional specific construction Work, closeout requirements are described in Divisions 02 thru 49 of the Specifications.

1.2 PROJECT RECORD

A. General: Project Record documents include the Contractor’s as-built Drawings, as-built Specifications, and as-built Shop Drawings required by the Contract Documents. Project Record documents must be protected from deterioration and stored in a secure fire-resistant location.

B. As-built Drawings: Maintain black line prints of the bid set Contract Drawings and approved Shop Drawings. Mark the drawings to show new information that was not shown on the bid set Drawings, and on the approved Shop Drawings, including the actual installation where the installation varies substantively from the work as originally shown. Mark drawings to show conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
   1. Organize as-built Drawings in manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.
   2. Mark with reproducible pencil and distinguish between variations in separate categories of the Work. Text size is to be 1/8” minimum. Good basic drafting practice must be applied.
   3. Show bid addenda items, Change Orders, and Request for Information (RFI) responses by their number, and date the revisions with a “cloud” around the revision.
   4. Keep accurate measurements of below-grade site work, including permanent shoring, in accordance with Section 01 71 23 “Field Engineering.”
   5. Show mechanical dampers, valves, reheat boxes, cleanouts, and other equipment and items that require maintenance.
   6. Show location of construction-concealed mechanical, electrical and plumbing (MEP) riser installations including, but not limited to, piping, ductwork, and conduits referenced to visible and accessible features.
   7. Show field changes of dimensions and details.
   8. X-out conditions not constructed and appropriately annotate “not constructed” to convey the actual as constructed condition.

C. As-built Specifications: Maintain one (1) copy of the bid set Contract Specifications showing all addenda, substitutions, Change Orders, and RFIs. Give particular attention to the selection of options, changes in product data, and information on elements engineered by the Contractor.
and note related as-built Drawing information, as appropriate. Clear, legible documentation must be applied.

D. As-built Shop Drawings: The Contractor shall comply with the following CAD (Computer-Aided Drafting), BIM (Building Information Modeling) and PDF (Portable Document Format) standards and requirements when preparing as-built record Shop Drawings required by the Contract Documents.

1. SUBMITTAL CONTENT
   A. Transmission
      1. Drawing package to be submitted using Owners’ construction management system (CMS).
   
   B. Included Drawings
      1. Submittal must include one Master Sheet Index on a single sheet that lists all drawing files submitted for all disciplines, including the sheet containing the Master Sheet Index. Only if the Master Sheet Index cannot fit on a single sheet may it be split over multiple sheet.
         a. For each file listed on the Master Sheet Index there must be one matching .DWG and one .PDF.
         b. Each drawing file provided in the submittal must be listed on the Master Sheet Index.
      2. If the Master Sheet Index is an OLE object, the index must also be submitted as an Excel .XLS or Text (.txt, .csv, etc.) file.

2. SHEET TITLEBLOCKS
   Sheets must contain a title block on the right or bottom side of the sheet. Title blocks must include labels and the following information:
   a. Date
   b. UW Project Name
   c. UW Project Number
   d. UW Facility Number (FACNUM)
      1. Every title block must include all FACNUMs affected by the project.
   e. Sheet Name
   f. Sheet Number
   g. Consultant Company Name
   h. Jurisdiction Seal where required by jurisdiction.
      1. Example: Within the City of Seattle

3. BIM STANDARDS
   Not Used

4. CAD STANDARDS
   A. Format
      1. CAD files must be submitted in AutoCAD .dwg format.
   B. File Organization
      1. Each CAD drawing file must represent a single printed sheet.
   C. File Names
      1. Drawing and PDF file names must be titled <Sheet Number> <Sheet Name>.
a. Examples: A-101 1ST FLOOR PLAN.dwg; A-101 1ST FLOOR PLAN.pdf

D. Image and .PDF References
   1. Unreferenced and Unloaded images must be detached from the drawing.
      a. No Unreferenced or Unloaded images or PDF underlays should appear in the Xref Manager

E. External References (XREFs)
   1. External drawing references are not allowed.
   2. External references used during the project must be bound using the ‘Bind’ option (instead of the ‘Insert’ option) before submitting.

5. PDF STANDARDS
   A. Single Sheet .PDF
      1. Each .PDF file must represent a single sheet and must not contain multiple pages.

   B. File Names
      1. .PDF file names must match the corresponding .DWG file names except for the file extension.

   C. File Creation
      1. .PDF files are to be created by printing from the native CAD/BIM format by printing to PDF. Scanning is not permissible.

   D. Layer Content
      1. .PDF files must not contain layers.

   E. Image Resolution (if applicable)
      1. All documents must be created with a resolution of no less than 300 dpi.

   F. Fonts
      1. All fonts must be embedded in the .PDF.

   G. Compression
      1. When compression is used, the algorithm must be LZW, CITT Group 4, or PackBits.

   H. Page Size
      1. The .PDF page size must be the same as the original page size if the page were printed.
         a. Example: ANSI D sized sheet must have a .PDF sheet size of 22 x 34.

1. CAD Compliance Submittal Review Requirements: CAD Shop Drawings shall be electronically submitted for Owner’s CAD compliance review and approval prior to submitting as-built record Shop Drawings. The Contractor may request a compliance review at any time during the work prior to Substantial Completion.

2. Project Record submittal: Provide all record as-built Shop Drawings required by the Contract Documents in CAD, BIM and PDF format (per the requirements of Section 01 33 00 “Submittal Procedures”).
   a. CAD files shall be submitted in latest release of AutoCAD .dwg format.
      1) Custom menus or arx applications are not allowed if they create a requirement for the drawing to be used. No menus, custom user interface files or arx applications are to be submitted.
      2) Each CAD drawing shall represent a single printed sheet where the file name conspicuously identifies the sheet number (e.g. sheet A2.1 CAD file name might be A2-1.dwg).
3) For all disciplines in a submittal, the CAD drawings shall be in a single folder. All supporting files (font files, line types, plot configurations, plot style tables, etc.) are to be in a subfolder.

1.3 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. Separate manuals shall be provided by the Mechanical and Electrical (M&E) Subcontractors titled MECHANICAL or ELECTRICAL and an additional manual provided by the General Contractor titled ARCHITECTURAL for all other information. The preliminary manuals shall be labeled “Preliminary” and comply with all requirements.

B. The O&M Manuals shall contain all the information needed to operate, maintain and repair all systems, equipment, and product finishes provided in the Project. They shall be presented and arranged logically for efficient use by Owner's operation personnel. As a minimum, the information provided shall include, but not be limited to, the following: (see Architectural, Mechanical and Electrical Divisions for additional requirements)

1. Product description including, but not limited to, manufacturer, product name or equipment make and model number (and other nameplate data), size and dimensions, color, Material Safety Data Sheets (and related product information), and other pertinent information
2. Supplier's name, address, e-mail address, phone, and reference order numbers
3. Product finishes maintenance and cleaning instructions
4. Performance and calibration data for specific product provided (extraneous catalog data must be eliminated)
5. Descriptions and diagrams of system assembly and configuration (including components and interrelations)
6. Manufacturer’s recommended equipment operating and maintenance instructions, including routine lubrication and servicing data, start-up and shutdown procedures, and any seasonal or emergency procedures
7. Manufacturer’s checklists and methods for troubleshooting
8. Complete parts list with parts numbers indicating common replacement parts and anticipated useful life
9. Copies of: digitally signed warranties; any certificates from respective manufacturers, suppliers, and Subcontractors; permits and/or licenses, and; equipment maintenance and service contracts.

C. The O&M Manuals shall contain the following information for specified items, when the item is specified elsewhere in the Contract Documents:

1. As-built door hardware schedule and submittal documentation
2. Elevator systems documentation
   a. Wiring/equipment locations diagrams
3. Refrigeration controls schematics/sequence of operation documentation
4. Motors data and variable frequency drives (VFDs) documentation
   a. Final settings programmed into the VFDs
5. Fan and pump curves documentation
6. HVAC filters schedule
7. Environmental controls systems (ECS) documentation including hardware and software manuals
8. Electrical—Short Circuit Coordination and Arc Flash Study Report
9. Pull calculations documentation for MV wire, cable, and terminations
10. Electrical transformer factory test reports documentation

D. Drawings included in the manual shall not exceed 11” x 17.”
E. Hard copy manuals shall be bound in a slant-D, 3-ring, view binder with a clear overlay insert on the front cover and spine.
   1. Provide a cover slip sheet and a spine sheet typed with ARCHITECTURAL, MECHANICAL, and (or) ELECTRICAL OPERATIONS AND MAINTENANCE MANUAL, University Project name, University Project number, University Facility number, A/E name, and Contractor name. Label manuals consecutively (ex., Mechanical 1 of 3).
   2. Each manual shall have a typed index and tabbed dividers between specification divisions and sections or, when presented in a logical format by Contractor and approved by Owner, between systems/equipment categories.
   3. Contents of the manual shall be printed on 8-1/2” x 11” acid free, recycled copy paper.

F. ARCHITECTURAL, MECHANICAL, and ELECTRICAL manuals may be combined into one manual, with approval of Owner.

1.4 WARRANTIES AND BONDS MANUAL

A. Assemble executed warranties and bonds, and any certificates from the respective manufacturers, suppliers, and Subcontractors. Provide preliminary review copies of all warranties and bonds and a final manual with the original documents, titled “Warranties and Bonds Manual.” Manuals shall be assembled in the same format as the O&M Manuals and include a table of contents in complete and orderly sequence.

1.5 OPERATING INSTRUCTIONS AND TRAINING

A. The Contractor shall provide on-site instruction and training for Owner’s personnel in all aspects of the philosophy, operation and maintenance of equipment and systems. Instruction and training shall be provided by a qualified trainer from the Contractor or Subcontractor who supplied and installed the equipment and systems and/or a manufacturer’s training representative who is familiar with all aspects of the design, operation, maintenance, and troubleshooting of the specified equipment and systems. Training shall be conducted in a classroom setting with appropriate schematics, handouts, and audio/visual aids. All training shall also be digitally recorded in video, cataloged, and provided to Owner in a DVD/container labeled with session identification and date. Attendance shall be recorded. For work requiring commissioning, see Section 01 91 00 “General Commissioning Requirements” for further training session agenda requirements.
   1. Prepare and submit a training plan for Owner’s information and coordination. For each training session, the training plan shall include the following:
      a. Dates, start and finish times, and locations
      b. Outline of the information to be presented
      c. Names and qualifications of the presenters
      d. List of texts and other materials required to support training

1.6 CLEANING

A. Contractor clean up during construction is specified in the Contract Documents.
   1. If Contractor fails to clean as specified in the Contract Documents, and after reasonable notification from Owner, Owner may do so and the cost thereof shall be charged to the Contractor.
   2. For work in medical centers, reference housekeeping in Section 01 35 33 “Infection Control.”
   3. Contractor shall employ continuous housekeeping cleaning during construction to minimize interior construction dust and particulates during the Work.
B. Preliminary Cleaning: Perform the following preliminary cleaning operations as a prerequisite for Owner’s Final Inspection. The following are examples, without limitation, of minimum cleaning requirements:

1. Remove labels that are not permanent.
2. Remove temporary protective coatings and wrappings from all products.
3. Remove glazing compounds and other vision obscuring substances from transparent and reflective materials provided by the Contractor including, but not limited to, mirrors, glass in doors and interior construction, glass canopies and skylights, and windows inside and out.
4. Clean all exposed building interior surfaces, including cabinet interiors, and new exterior surfaces to be free of foreign substances including, but not limited to, stains and films.
5. Leave floors broom-clean. Vacuum carpeted surfaces and clean consistent with manufacturer's recommendations for installation.
6. Remove and clean all construction debris and refuse from:
   a. Roofs, mechanical and electrical rooms, tunnels and equipment vaults
   b. Limited access spaces, including above ceiling areas and shafts
   c. Physically inaccessible components of the Work including wall and chase cavities, gutters and downspouts, floor drains and other drainage systems
7. Wipe surfaces of M&E equipment, including elevator equipment and similar Architectural equipment. Remove excess lubrication and other substances.
8. Clean the Project site of construction waste, rubbish, and litter. Sweep paved areas broom clean and remove stains, spills, and other foreign deposits.

C. Final Cleaning: Prior to Substantial Completion, employ experienced workers or professional cleaners for final cleaning of the Work. Clean to a condition expected of a normal commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Leave entire Project clean and ready for occupancy. All new interior, including cabinet interiors, and exterior building surfaces, fixtures and equipment shall be turned over to the Owner in a new condition, free of all damage, dust, dirt, spots, stains, encrustations, and other blemishes.
2. Clean transparent materials including mirrors, glass in doors and interior construction, glass canopies and skylights, and windows inside and out.
3. Clean plumbing fixtures to a sanitary condition.
4. Clean light fixtures and lamps.
5. Owner will wax and apply sealers to vinyl composition tile and sheet vinyl floors.

D. Compliance: The Contractor shall:

1. Use non-toxic Green Seal Certified cleaning products, or products with low-volatile organic compounds (VOC), and cleaning paper with a post-consumer recycled content;
2. Employ equipment with high efficiency particulate filtration and sweep compound to keep dust down; and
3. Comply with current regulations and standards of authorities having jurisdiction and the safety standards for cleaning specified in the manufacturer’s instructions.

1.7 OWNER’S FINAL INSPECTION

A. Prior to Final Inspection: The Contractor shall satisfactorily complete the following actions prior to the Owner's final inspection of the Project.

1. Submit written notice that the Project is ready for final inspection. Include a copy of the Contractor’s final punch list report (see Section 01 45 00 “Contractor Quality Control”) and list all incomplete work items that have been reviewed with the Owner, and which the Owner has agreed are not necessary prior to Substantial Completion.
   a. Include: a written plan/schedule outlining all actions necessary to achieve Substantial Completion, without requiring extra ordinary participation by Owner and A/E.
2. Complete preliminary cleaning operations.
3. Submit a list of all equipment and systems requiring instruction and training with a proposed schedule of times and locations for the instruction, for Owner’s review and comment.
4. Replace all ventilation systems air filters specified for construction with final filters.

B. Re-inspection: Contractor shall request, in writing, re-inspection after completing the Owner’s final inspection list of corrective work items and providing the Owner the final inspection report notated with a signed-off approval for each of the corrected items. Those items whose completion is delayed due to circumstances acceptable to the Owner will be exceptions. The Owner’s Representative will back check the items or have the A/E perform a re-inspection.
   1. If the A/E is required to perform more than one re-inspection, the costs for additional inspections may be borne by the Contractor, at the Owner’s sole discretion.

1.8 SUBSTANTIAL COMPLETION

A. Substantial Completion: Substantial Completion (for either the entire Work or portions thereof) shall be achieved when all Work, other than incidental corrective and incidental punch list work, is complete including, but not limited to, the following actions:
   1. Complete final cleaning operations.
   2. Submit the "Preliminary" Operations and Maintenance Manual for Owner’s review and comment in one (1) hard copy and in PDF format, on Owner’s CMS.
   3. Submit all sign-offs, releases, jurisdictional settlements, judgments, and other records from AHJ allowing the Owner’s full and unrestricted use and benefit of the facilities including, but not limited to, a temporary or permanent certificate of occupancy permit, operating permits and/or licenses for the use of building equipment such as elevators, boilers, paint booths, etc. and similar necessary certificates and releases.
      a. Provide a list of any outstanding work required by AHJ.
   4. Submit the current Project Record as-built Drawings and Specifications identified "Preliminary" Project Record (marked with the date of submission) in PDF format, on Owner's CMS.
   5. Submit the Project Record as-built Shop Drawings required by the Contract Documents in accordance with this Section 1.2D, on Owner’s CMS.
   6. Remove all construction tools and temporary facilities not required for Final Completion work from the Project site including, but not limited to, storage sheds, samples and mock-ups, Project identification signage, site fences, crane and hoist base foundation construction, temporary enclosures, and construction electrical power and service.
   7. Complete Owner's personnel operating instructions and training and submit training DVD's.
   8. Deliver specified maintenance equipment and tools to Owner, with itemized summary list.
   9. Complete final change-over of locks, transmit new keys to Owner, and return Owner’s loaned construction keys.
10. Complete all air balancing, testing and commissioning work required by the Contract Documents, allowing the Owner to fully occupy the Work for the use for which it is intended. Incidental Work, that is not life safety or occupational safety commissioning work, whose completion is delayed due to circumstances excused by the Owner, will be the exception.
    a. Submit one (1) hard copy each of the current environmental control systems point-to-point testing documentation and (when specified as work of the Contractor) the current Testing, Adjusting and Balancing (TAB) report (marked with the date of submission).
11. Submit all controls systems software files required by the Contract Documents including, but not limited to, lighting and environmental controls.
B. Substantial Completion: Upon a satisfactory completion of the actions in 1.8A above and the General Conditions requirements for Substantial Completion, the Owner will prepare a letter of Substantial Completion and forward to Contractor. The letter will identify the date of Substantial Completion and include the final punch list report and the commissioning deficiencies list, listing all remaining incomplete work. Contract warranties will begin as of the date of Substantial Completion, as specified in Section 01 78 36 “Warranties,” or as otherwise indicated in the Contract Documents.

1. Substantial Completion and the start of warranties for incomplete items will be established in writing by the Owner when the item is determined complete.

1.9 FINAL COMPLETION

A. Prior to Final Completion: Final Completion shall be achieved when the Work is fully and finally complete, to the Owner’s satisfaction in accordance with the Contract Documents including, but not limited to, the following:

1. All Work, including incidental corrective or punch list work, and air balancing and commissioning work (if included in the scope of the Work) is complete and correct to the satisfaction of the Owner.
2. All remaining temporary facilities are removed from the Project site and the site (including landscape) is restored to original conditions or Contract Documents requirements.
3. All final permits, originally issued as temporary permits, have been submitted.
4. The final marked-up Project Record as-built Drawings and Specifications identified Final Project Record (marked with the date of submission) have been submitted using Owner’s construction management system (CMS).
5. The complete Operations and Maintenance Manual and Warranties and Bonds Manuals have been submitted in PDF format, on Owner’s CMS, and a hard copy of the Warranties and Bonds Manual with original documents has been submitted.
6. The Contractor’s final 3-ring binder of all MSDS used for construction, marked with the date of submission, has been submitted in PDF format, on Owner’s CMS.
7. The Contractor’s final cumulative Construction Waste Management Report (marked with the date of submission) has been submitted in PDF format, on Owner’s CMS.
8. All Change Orders are approved and signed by both parties.
9. A draft of the Final Application for Payment has been submitted to Owner for review and approval.
10. The final Schedule of Values and the Building Componetization Report in hard and electronic copies (see Section 01 29 76 “Progress Payment Procedures”) have been submitted.
11. The final air balancing report and the final M&E Commissioning Binders (marked with the date of submission) have been submitted in PDF format, on Owner’s CMS.
   a. For Projects with a Test Engineer, the as-built information updating the A/E commissioning basis-of-design has been submitted with the Commissioning Binders.
12. The final environmental control systems point-to-point testing documentation and (when specified as work of the Contractor) the final air balancing report marked with the date of submission, has been submitted in PDF format, on Owner’s CMS.
13. For Projects at the UW Warren G. Magnuson Health Sciences Center, UW Medical Center, and Harborview Medical Center; all personnel identification badges have been returned.

B. Final Completion: Upon satisfactory completion of the requirements in 1.9A above to achieve Final Completion, the Owner will approve and process the final Application for Payment and establish the date of Final Completion thereon.
1.10 FINAL ACCEPTANCE

A. Final Application for Payment has been approved by Owner and payment made to the Contractor.

B. The Owner will establish the date of Final Acceptance and issue the letter of Final Acceptance after the Contractor has completed the requirements of the Contract Documents.
   1. The Contractor shall follow the requirements outlined in the General Conditions and Section 01 29 76 “Progress Payment Procedures” for release of retainage.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer’s standard warranties on products and special warranties.

1. Refer to the following General Conditions for terms of the Contractor’s warranty of Work:
   a. Part 5.16 “Correction of Non-conforming Work”
   b. Part 5.21 “Warranty of Construction”
      1) If there is any discrepancy in the Contract Documents regarding the warranty period or its date of commencement, the specified passage granting the Owner the longest warranty period ending on the latest date shall govern.

2. General closeout requirements are included in Section 01 77 00 “Closeout Procedures.”

3. Specific requirements for warranties for the Work and products and installation that are specified to be warranted are included in the individual sections of the Specifications.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer’s disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors that are required to countersign special warranties with the Contractor.

1.2 DEFINITIONS

A. “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. “Special Warranties” are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.3 WARRANTY REQUIREMENTS

A. General: Upon determination that Work covered by a warranty has failed, correct or replace the Work to an acceptable condition complying with requirements of Contract Documents.

B. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected or replaced and retested and/or re-commissioned reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

D. Costs: The Contractor is responsible for the cost of correcting or replacing including the cost for retesting and/or re-commissioning defective Work, regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
E. Owner’s Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

2. Right to Refuse Work: The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

A. Submit written warranties to the Owner’s Representative. Provide a draft for Owner’s review and comment prior to final execution. Warranties shall identify:

1. Scope description of what is covered (indicate labor and/or materials requirements);
2. The Specification reference stating the warranty;
3. The date of the warranty’s start and finish (indicate the specified warranty duration);
4. Service and maintenance contracts, when specified in the Contract Documents;
5. Supplier’s name, address, e-mail address, and telephone number;
6. Proper procedure in case of failure; and
7. Instances which might affect validity of warranty.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier, or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties.

1. Refer to individual sections of the Specifications for specific content requirements, and particular requirements for submittal of special warranties.

C. Include warranties in the Operations and Maintenance Manual (see Section 01 77 00 “Closeout Procedures”).

D. Review and acceptance, by the A/E or Owner’s Representative, of submitted warranties does not relieve the Contractor of the warranty requirements of the Contract Documents.

E. The Owner may generate and keep electronic copies of original executed warranties, certifications, and other similar commitments and such copies shall be considered as originals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)
PART 1 - GENERAL

1.1 SUMMARY

A. Comply with the commissioning provisions specified in this Section and elsewhere in the Contract Documents.

B. General:
   1. Unless noted otherwise, functional performance tests (FPT) apply to all equipment and systems identified to be tested in the Contract Documents.
   2. Submittals shall be in accordance with Section 01 33 00 “Submittal Procedures” and for CAD (Computer Aided Drafting) Record Drawings, in accordance with Section 01 77 00 “Closeout Procedures.”
   3. The duties of the Contractor’s “Test Engineer” and Owner’s “Commissioning Authority” are described in Section 01 75 00 “Test Engineer Services.”
   4. The Contractor shall ensure that the Commissioning Authority, or other Owner-designated witness, is provided safe access to witness the performance of the equipment or systems being commissioned and is reasonably furnished ladders, scaffolding, and staging, if required, for witnessing.

1.2 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: The Contractor shall prepare and submit a “Commissioning Plan” that identifies how commissioning activities will be integrated into the construction Progress Schedule and how commissioning responsibilities are distributed. Include, as a minimum, the following:
   1. An organizational chart showing lines of communication and authority of the Test Engineer relative to key Contractor positions and to key Subcontractors
   2. Who will be responsible for producing the various procedures, reports, Owner notifications, and forms required by the Contract Documents
   3. List of all control systems software required by the Contract Documents
   4. The commissioning schedule
   5. Commissioning forms and other documentation
   6. Description of start-up and test procedures
   7. List of Subcontractors who will participate in each of the tests
   8. The instrumentation required for each test and who will provide the instrumentation
   9. Operational description for each test (This shall include, for example, the commissioning basis-of-design criteria provided by the commissioning authority, code requirements, the specifics of the equipment to be provided, sequences of operation, operating priorities, and other necessary information.)
   10. One-line system and riser diagrams

B. Mechanical and Electrical Commissioning Binders (M&E): The M&E “Commissioning Binders” shall include the submittals, test equipment, commissioning procedures, installation verification audits, and FPT procedures documentation described in this Section.

1.3 SUBMITTALS

A. Start-up plans: Submit start-up plans, with start-up test procedures and documentation forms, for the equipment and systems for which a start-up is specified in the Contract Documents. Start-up plans shall include the following:
   1. Start-up schedule
   2. Names of firms/individuals required to participate
   3. Detailed start-up procedures
4. Start-up forms
5. Operations and maintenance product data

B. Start-up installation verification audit report: Submit installation verification audit reports prior to start-up of equipment and systems for which a start-up is specified in the Contract Documents. Identify:
1. Equipment and/or systems, to be started-up;
2. Prestart-up tests performed, including manufacturer’s factory tests;
3. Deficiencies noted;
4. Corrective action taken; and
5. Dates and initials of persons making the entries.

C. Start-up deficiency report form: Submit start-up deficiency report forms within five (5) days following the start-up of each equipment or system to report any deficiencies discovered in conjunction with start-up. Identify:
1. Equipment and/or systems started-up;
2. Location and identification of the deficient equipment and/or materials;
3. Date of observation and initials of observer;
4. Deficiencies noted;
5. Corrective action taken; and
6. Date of correction and initials of the person making the correction.

D. Test equipment identification list: Submit a list of all test equipment used in commissioning, sorted according to intended use. Provide an updated list, if any equipment is added to the commissioning, while testing is in progress. The list shall include the following information:
1. Manufacturer
2. Model number
3. Serial number
4. Date of most recent calibration
5. Range
6. Accuracy
7. Resolution
8. Intended use

E. Testing, Adjusting and Balancing (TAB) progress reports: Submit weekly TAB progress reports after TAB activities have begun. Identify the following:
1. Systems or subsystems for which preliminary balancing is complete
2. Systems or subsystems for which final balancing is complete
3. Status of deficiencies and balancing problems encountered, including corrective actions taken
4. Updated schedule of remaining TAB activities

F. FPT procedure documentation: Submit FPT procedure documentation for FPT specified in the Contract Documents. The documentation shall include the following:
1. FPT procedure description
2. Procedures that are based upon the actual equipment and/or systems configuration
3. The value for all set points and inputs, positions of adjustable devices, valves, dampers and switches
4. The acceptable test range for each FPT
5. Updated one-line system and riser diagrams
6. An alphanumeric designator for each procedure
7. Reference to the applicable Specifications section upon which the procedure is based

G. FPT data forms: Submit FPT data forms to document the equipment or systems FPT specified in the Contract Documents.
1. Identify each FPT data form by a unique designator, consisting of an applicable FPT procedure designator followed by a dash and digit suffix to distinguish multiple repetitions of the same procedure.

2. The FPT data form shall identify:
   a. Who needs to be in attendance for the tests, including but not limited to, Subcontractors, Commissioning Authority or other Owner-designated witness, regulatory agencies, and others as appropriate; and
   b. The sequence of the tests to be performed.

3. Include space to record the following:
   a. Description of the procedure
   b. Whether the form is for a retest of a failed procedure
   c. Identification and location of the equipment being tested
   d. Identification of instrumentation used, by type and serial number
   e. Observed conditions at each step of the procedure
   f. Acceptable results, as specified
   g. Date of the test
   h. Names of technicians performing the procedure
   i. Name and signature of the Contractor’s Test Engineer
   j. Name and signature of the Commissioning Authority or Owner-designated witness
      1) Signature of witness shall only indicate concurrence with reported results and observations. Acceptance of the results will be reported separately by the Commissioning Authority after review of the FPT data forms.

H. FPT deficiency report forms: Submit FPT deficiency report forms at the end of each day for all tests in which acceptable results were not achieved during the day. When corrections have been completed, update the FPT deficiency report form. FPT deficiency report forms shall record the following:
   1. Associated FPT data form number and description
   2. Equipment identification and location
   3. Date of test
   4. Name of person reporting the deficiency
   5. Description of the observations associated with the failure of the test
   6. Cause of the failure, if apparent at the time of the test
   7. Date and description of corrective action taken
   8. Name and signature of person taking corrective action
   9. Schedule for retest

I. One-line system and riser diagrams: Submit one-line system and riser diagrams with the Commissioning Plan, updated one-line system and riser diagrams with the FPT procedure documentation, and as-built one-line system and riser diagrams with the final M&E Commissioning Binders. One-line system and riser diagrams shall be submitted for the following, when included in the work of the Contract Documents:
   1. Owner-provided one-line system and riser diagrams in CAD format for Contractor’s use:
      a. Hot water heating
      b. Domestic water
      c. Steam and condensate
      d. Chilled water
      e. Condenser water
      f. Supply air
      g. Return air
      h. Exhaust air
      i. Electrical normal and emergency power
   2. Subcontractor-provided one-line system and riser diagrams CAD Shop Drawings, for Contractor’s use:
      a. Environmental control systems (ECS)
b. Fire alarm/smoke evacuation/life safety graphics and riser diagrams

c. Lighting control system diagrams

d. Electrical distribution equipment and spot or network substations schematic diagrams

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide industry standard test equipment required for performing the tests specified in the Contract Documents.

B. Instrumentation shall meet the following standards:
   1. Be of sufficient quality and accuracy to test and measure system performance within the tolerances required to determine adequate performance
   2. Be calibrated on the manufacturer’s recommended intervals with calibration tags permanently affixed to the instrument being used
   3. Be maintained in good repair and operational condition throughout the duration of use on this Project
   4. Be recalibrated/repairsed if dropped or damaged in any way since last calibrated

C. For all temperature measurements, including air, liquids, and surfaces of pipes and components, use appropriate probes that meet the following requirements:
   1. Range: Minimum +14°F to 248°F
   2. Type: Thermometer, digital electronic
   3. Minimum accuracy: +/- 0.5°F
   4. Calibration Interval: Per manufacturer instruction, not to exceed every twelve (12) months.

D. For hydronic systems pressure and differential pressure measurement instruments, the test equipment shall meet the following requirements:
   1. Range: 0 to 30 psi (1 pound per square inch), 0 to 60 psi, and 0 to 200 psi
   2. Type: Calibrated test gauges, 3 inch, or electronic digital device (TSI Performance Measurement Tools or similar) meeting accuracy and calibration interval requirements.
   3. Minimum accuracy: 2% with a gauged scale; 3% with an electronic reading
   4. Calibration interval: Per manufacturer’s recommendation, not to exceed every twelve (12) months.
   5. Note: Use lowest range instrument or scale

E. For air pressure measurement instruments, the test equipment shall meet the following requirements:
   1. Range: 0 to 1 inch WC (water column), 0 to 4 inch WC, 0 to 10 inch WC
   2. Type: Use properly leveled and zeroed manometer, magnehelic or electronic instrument meeting accuracy requirements
   3. Minimum accuracy for electronic devices: 2% with a magnehelic reading; 3% with an electronic reading
   4. Calibration interval for electronic devices: Per manufacturer’s recommendation, not to exceed every twelve (12) months
   5. Note: Use lowest range instrument or scale

F. Refer to electrical inspection, calibration, and testing requirements for instrumentation related to electrical systems and equipment.
PART 3 - EXECUTION

3.1 COMMISSIONING PROCEDURE

A. Sequence of testing: Commissioning shall proceed from lower to higher levels of complexity. For each system, testing at the lower level shall be completed prior to starting the next higher level of tests. In general, the order of testing, from lowest to highest is as follows:
   1. Static tests (e.g., duct leakage tests)
   2. Motors, actuators, sensors, and other system components requiring start-up and FPT
   3. Point-to-point (PTP) testing
   4. Balancing
   5. System functional performance tests
   6. Cross-systems functional performance tests

B. Retesting: Repeat, at no additional cost to the Owner, the complete functional test procedure for each test in which acceptable results are not achieved. Repeat tests until acceptable results are achieved. Fill out a new FPT data form for each retest.

C. Correction of deficiencies:
   1. Correct FPT deficiencies promptly and schedule retest.
      a. Corrections during FPT are generally prohibited to avoid consuming the time of personnel waiting for the test, but not involved in making the correction. Exceptions will be allowed if the cause of the failure is obvious and corrective action can be completed in less than five (5) minutes. If corrections are made under this exception, the failure shall be noted on the FPT data form. A new FPT data form, marked “retest”, shall be submitted after the correction has been made. The entire FPT procedure shall be repeated.

3.2 INSTALLATION VERIFICATION AUDIT

A. Conduct an installation verification audit before equipment or system start-up begins. The audit shall include, but not be limited to, a check of the following equipment or systems:
   1. Piping specialties, including balance, control, and isolation valves
   2. Ductwork specialty items, including turning devices; balance, fire, smoke and control dampers; and access doors
   3. Control sensors by type and locations
   4. Piping, valves, starters, gauges, thermometers, and other components of the Work specified for formal start-up in the Contract Documents
   5. Accessibility to equipment in 1 - 4 above
   6. Verification of final programmed variable frequency drives (VFD) settings

B. If any part of the Work is found to be incomplete, inaccessible, incorrect, or non-functional, the Contractor shall make note of deficiencies, and correct deficiencies before system start-up work proceeds.

C. Coordinate with the electrical testing contractor (ETC) for the audit of electrical systems required by the Contract Documents.

3.3 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Complete all PTP testing prior to start of TAB.

B. Coordinate and perform air and hydronic balancing. Advise the TAB firm when systems are complete and ready for balancing. Start TAB as early as possible following system start-ups.
and component FPT, in order to be essentially complete prior to system FPT. Coordinate TAB activities with other construction schedule activities.

C. Verify completion of PTP testing and the accuracy of the TAB work prior to commencing any FPT activities which may be adversely affected by incomplete PTP testing and improper balancing.

3.4 FUNCTIONAL PERFORMANCE TEST PROCEDURES

A. FPT procedures must confirm the performance of systems to the extent required by the Contract Documents.
   1. Emphasis shall be placed on testing procedures which will conclusively determine actual system performance and compliance with the design.

B. FPT procedures shall demonstrate the actual performance of specified safety shut-offs in a real or closely simulated condition of failure. Failure conditions shall include adequate oil pressure, proof-of-flow, non-freezing conditions, maximum head pressure, and other conditions common to the equipment.

C. Systems may include safety devices and components that control a variety of equipment operating as a system. Interlocks may be hard-wired or installed via software. FPT procedures shall demonstrate these interlocks.

3.5 ECS SOFTWARE REVIEW

A. Review ECS software and required ECS cross-systems software routines prior to the installation of control devices. The review shall include:
   1. Obtaining ECS program documentation
   2. Review of the programming approach
   3. Interface with other systems, including but not limited to:
      a. Lighting
      b. Fire alarm
      c. Security
      d. Clock
      e. Emergency generator monitoring
      f. Sump pumps
      g. Distributed and mechanical utility metering

B. Discrepancies in programming approaches shall be resolved with the Owner to provide the most appropriate, simple, and straightforward approach to software routines.

3.6 COMMISSIONING MEETINGS

A. The Contractor shall participate in the following meetings with the Commissioning Authority. Other Subcontractors may, at Owner’s sole discretion, be required to attend as necessary.
   1. Pre-commissioning kick-off meeting
   2. Commissioning meetings described in Section 01 31 19 “Project Meetings”
   3. ECS software review, and design intent clarification meeting
   4. Preliminary O&M Manual review meeting

3.7 EQUIPMENT OPERATING INSTRUCTIONS AND TRAINING AGENDA

A. Each training session shall include an agenda addressing the following:
   1. Introduction of presenters
2. Using the O&M information:
   a. What is the equipment
   b. Basic operating procedures (including start-up/shut-down)
   c. Preventative maintenance procedures
   d. Troubleshooting procedures
3. What does it do, or serve
4. Any special features
5. Safety precautions
6. Maintaining warranties, guarantees, and warranty periods
7. Instruction on how to use proprietary instrumentation or operating equipment
8. Recommended spares
9. Review of start-up reports and FPT results
10. Jobsite walk-through

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. The work includes selective demolition within the existing buildings.
2. The Contractor is responsible for determining scope and extent of demolition in order to allow for installation of the work shown on the Drawings. Specific demolition notes are indicated on the Drawings that are in addition to the Contractor’s required scope to accommodate the new work.
3. Contractor is warned that there may be unknown alterations and unforeseen or unknown conditions above existing ceilings, behind existing wall furring, below concrete floor slabs, and within existing walls, and partitions.
4. Refer to Mechanical and Electrical drawings and specifications for additional requirements.
5. Demolition work includes protection of existing construction to remain, as well as removal and disposal of demolished materials.

B. Salvage: Owner will mark and retain salvageable items as determined with the Contractor.

C. Related Sections:

1. 01 35 33 – Infection Control.
2. 01 50 00 – Temporary Facilities and Controls: Requirements for fire prevention, dust and noise control, security, barriers, etc.
3. 01 73 29 – Cutting and Patching.
4. Divisions 22 and 26: Demolition, removal and disposition of pipes, conduits, ducts, equipment and other mechanical and electrical work is specified in these Divisions.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

1. A10.6 - Safety Requirements for Demolition.
2. A10.18 - Safety Requirements for Temporary Floor and Wall Openings, Flat Roofs, Stairs, Railings and Toe boards.

1.3 ASBESTOS AND PCB

A. Hazardous Materials: Refer to Section 01 11 01.

1.4 SUBMITTALS

A. Schedule: Submit proposed methods and sequence of operations for selective demolition prior to preconstruction meeting. Coordinate all times with the Owner and obtain approval of schedule before commencing. Include the following:
1. Detailed sequence of demolition and removal of work to ensure Owner time to vacate areas and allow Owner continuing occupation of portions of existing building.
2. Indicate any temporary suspension of services and duration of these times.
3. Coordination for shut-off, capping, and continuation of utility services as required.
4. Details for dust and noise protection.

B. Photo Survey: As specified in paragraph 3.1.

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with applicable requirements of rules, regulations, laws, ordinances of governing authorities.

B. Cutting and Patching: All selective demolition work that requires cutting and patching shall conform to the requirements specified in Section 01 73 29 Cutting and Patching. Do not cut and patch work exposed on the building exterior or in its occupied spaces in a manner that would, in the Architect's opinion, result in lessening the building aesthetic qualities. Do not cut and patch work in a manner that would result in substantial visual evidence of cut and patch work.

1.6 PROJECT CONDITIONS

A. Occupancy: Owner will be continuously occupying areas of the building immediately adjacent to areas of selective demolition. Conduct demolition work in a manner that will minimize need for disruption of Owner's normal operations.

B. Existing Building Exits: Contractor's materials and activities shall not block any exit or impair floor-to-floor separation while the building is occupied.

C. Partial Removal: Items of salvaged value to Contractor may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage of removed items on site will not be permitted.

D. Fire Protection: All practical measures shall be taken to ensure fire protection during all phases of the work. This shall include expediting construction of fire division walls, temporary cross hallway fire stop at the division walls, and securing the building from unauthorized entry. No flammable liquids, welding/cutting equipment, or compressed gases shall be used, except under specific Fire Department Permit and approval from the Owner.

E. Protection: Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition.

1. Provide protective measures as required to ensure free and safe passage of Owner's personnel and general public to and from occupied portions of the building.
2. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
3. Protect floors with suitable coverings when necessary.
4. Construct temporary dust proof partitions to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dust proof doors and security locks, if required.
5. Remove protections at completion of work and restore effected finishes.
F. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

G. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction and the Owner. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities. Refer to 01 50 00 “Temporary Facilities and Controls” for utility shut-down procedures.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Provide all materials, equipment, tools, and methods required for the completion of demolition work as indicated and specified hereinafter.

PART 3 – EXECUTION

3.1 INSPECTION

A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions of structure, surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner prior to starting.

3.2 PREPARATION

A. Erect and maintain dust-proof partitions and closures as necessary to prevent spread of dust or fumes to occupied portions of the building.

1. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions. Refer to Section 01 35 33 “Infection Control” for containment requirements.

3.3 DEMOLITION

A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated or required.

B. Contractor shall first remove gypsum wallboard or plaster fromexisting walls to be removed, ceiling tiles, gypsum wallboard or plaster from existing ceilings to be removed to allow inspection of existing plumbing, HVAC ducts and other mechanical and electrical items.

1. After mechanical and electrical items have been uncovered, Contractor shall notify the Owner if there are any questions or if it is unclear as to the future status of these items (i.e. remove, cap or reroute).
C. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw.

D. Where partitions are designated or required to be removed, remove all doors, frames, relites, equipment and associated mechanical and electrical items. Patch floors, walls, columns, and ceilings to remain where they intersect with walls to be removed. Patch, repair, or infill existing suspended ceiling grids that are designated or required to be removed.

E. Remove resilient wall base from walls and columns wherever walls intersect areas scheduled to receive new carpet.

F. Remove existing resilient floor tile and sheet vinyl in areas as indicated or required. Existing adhesive must be completely removed. If existing adhesives were cutback or emulsion type asphalt, grind substrate using concrete or terrazzo grinding machines. After grinding, coat floor area using a latex patching material as recommended by new floor covering manufacturer.

G. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner in written, accurate detail. Pending receipt of directive from Owner, rearrange selective demolition schedule as necessary to continue overall job progress without delay.

3.4 REMOVALS

A. Remove debris, rubbish and other materials resulting from demolition operations from building on a daily basis. Transport and legally dispose of material off-site.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall perform all planning, notifications, administration and execution necessary to safely remove, abate, dispose and/or handle the regulated materials listed within this Section in accordance with local, state and federal regulations.

1.2 RELATED WORK

A. Drawings, General Conditions, Modifications to the General Conditions, and Supplemental Conditions to the General Conditions, and other Divisions apply to this Section.

1.3 WORK INCLUDED

A. The Contractor shall supply all labor, equipment, notifications, services, insurance, special permits and equipment necessary for the following regulated materials:

1. Asbestos:

a. Asbestos abatement is not included in this Project. Refer to other sections for Infection Controls or Covid-19 mitigation plan for safe work practices and procedures and associated implementation.

b. Contractor shall refer to the Hazardous Materials Survey Report (Attached in Appendix C and prepared by PBS Engineering and Environmental). This document lists suspect asbestos-containing materials (ACM) sampled and analyzed for asbestos content, or presumed to exist, at the areas of the building included in the Work. The Contractor shall ensure that copies of this information are made available to and retained at the project site by all subcontractors. Asbestos-containing materials were not identified at the project site.

c. Contractor shall be aware that suspect-ACMs may exist in inaccessible locations of the spaces included in the Work and in areas not included in the Work.

d. Contractor is advised that, should additional ACMs not included in the Hazardous Materials Survey Report be encountered, the Owner may elect to include the abatement of such materials in the work at a mutually agreed upon price. Work impacting such materials is not to occur prior to the Contractor receiving explicit written authorization from the Owner, and any Work performed without such approval is performed at the Contractor’s own risk and expense.

e. The disturbance or impact of ACMs may cause asbestos fibers to be released into the building’s atmosphere, thereby creating a potential health hazard to building and tunnel occupants. Contractor is to apprise all workers, supervisory personnel, subcontractors and consultants who will be at the jobsite of the seriousness of this potential hazard and of proper Work procedures that must be followed, should it occur.
f. Where in the performance of the Work, workers, supervisory personnel, subcontractors, or consultants encounter, disturb, or otherwise function in the immediate vicinity of any identified ACMs, Contractor shall take appropriate continuous measures, as necessary, to protect its employees, sub-contractors, building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with applicable local, state and federal regulations.

g. Damage of Asbestos by the Contractor: Damage to asbestos-containing materials to remain caused by the Contractor shall be repaired to the satisfaction of the Owner by the Contractor using certified asbestos workers according to these specifications, and at the sole expense of the Contractor.

2. Metals/Lead:

a. Lead-containing paint was not identified limited to the areas of the project site located at the UWMC Surgery Pavilion.

b. The Owner’s consultant has conducted a survey of representative areas in the Building to be impacted by the Work for the presence of lead-containing components. Findings and related analytical data are included in the attached Appendix C Hazardous Materials Good Faith Survey Report. Lead-containing paint was not identified at the project site.

c. Contractor shall comply with all applicable Metals regulations, laws and ordinances concerning the impact, removal, handling, storage, disposal, monitoring and protection against exposure or environmental pollution related to building components containing lead coatings or lead products. Impacts to lead that may be required by the Work include, but are not limited to; product installation, manual demolition, mechanical demolition, cutting, sawing, drilling, sanding, scraping, welding or torch-cutting. Confirm required impacts with other applicable specification sections and drawing sheets. In addition, provide all infection controls and engineering controls per contract requirements.

d. Work impacting lead/metals-containing painted coatings and lead/metals-containing items and products within this contract is the responsibility of the Contractor, and all affected Sub-Contractors, and shall be performed in accordance with all applicable local, state and federal regulations.

3. Polychlorinated Biphenyls (PCBs)

a. PCB-containing light ballast or leaking ballasts were not identified at the project site.

e. Representative light ballasts inspected were found to be labeled “No PCBs” or the electronic types without suspect potting compound. However, all magnetic ballasts not marked (unlabeled) or labeled with “No PCBs” must be segregated and recycled through the Owner as they may contain PCBs in low concentrations. As part of the scope of the project, contractor is to inspect light fixtures and individual ballast (magnetic devices for suspect potting compound regardless of labeling) during demolition activities for proper handling and disposal/recycling.
f. Contractor is responsible for handling, removal, and proper storage of magnetic ballasts for Owner disposal in accordance with applicable local, state and federal regulations and these Specifications. Remove all magnetic ballasts (labeled or unlabeled with “No PCB”) as part of the scope for proper disposal by Owner.

g. Provide U.S. Department of Transportation approved 55-gallon drums (with approved lid) and deposit all removed ballast into containers.

h. Drummed ballast will be disposed-off or recycled by Owner through the UW Environmental Program Office (EPO) as a state regulated waste.

i. Prevent damage to any unlabeled ballasts and immediately report any leaking ballasts to the Owner's Representative.

j. Submit for review a work plan to address handling and removal of PCB-containing light ballast (labeled and non-labeled) including all appropriate worker protection, environmental controls, and cleanup procedures.

4. Mercury

a. Fluorescent Lighting Tubes/Bulbs and Thermostats.

i. Work includes handling and removing of light tubes, compact bulbs, high-intensity discharge lamps and thermostats for Owner to properly dispose. Fluorescent lighting tubes/bulbs and thermostats may not be disposed of as construction debris because they contain mercury. Thermostats and whole/intact fluorescent and shall remain intact during handling, removal, storage, and transportation.

ii. Thermostats, whole fluorescent light tubes/bulbs and light ballast from the project on the Seattle campus are recycled through UW Recycling Program. Coordinate with the Owner’s representative for the recycling program. To initiate this process, the Owner will contact UW Recycling by calling the Recycle Information Line at 206.685.2811 or sending an email to recycle@u.washington.edu at a minimum one week prior to the scheduled removal of lamps.

iii. The Owner’s fluorescent tube recycling vendor will drop off and subsequently pick up the appropriate number of fiber drums at the project location on specified dates – coordinate with Owner for logistics. The project will be billed directly for tube recycling. Fluorescent tubes must be managed under the state Universal Waste rules. This means that all fluorescent tube drums must be labeled as Universal Waste (usually the recycling contractor does this, but it is the ultimate responsibility of the Owner to label them). The drums must also be under the generator’s control at all times and must be stored at a covered or indoor site.

iv. Damaged and broken tubes/bulbs are disposed of as hazardous waste through the UW Environmental Program Office (EPO) as well. Contractor to provide to Owner for review their work plan to address handling and removal of light tubes and light ballast including all appropriate worker protection and environmental controls.
5. Refrigerants (Not Used)
   
   a. Coordinate with the Owner prior to refrigerant-containing equipment altering work, demolition, installation and any refrigeration discharge activities.
   
   b. All University air conditioning, chiller or refrigeration equipment (including removal of equipment) or installing new equipment, contractor shall notify the Facilities Services Refrigeration Shop Supervisor at (206) 685.8835 or (206) 543.3010 - UW Seattle main campus.
   
   c. Submit to Owner a work plan for the demolition, decommissioning and dismantling of equipment that may contain refrigerants (chiller unit). All ozone-depleting refrigerants (CFC) including HCFCs and HFCs must be recovered from equipment and appliances prior to demolition or disposal. It is the responsibility of the contractor to ensure recovery machines, gauges and other recovery equipment shall meet the required standards for evacuation levels, hydrostatic testing dates, DOT guidelines, color coding, cylinder identification and pressure ranges per Section 608 of the Federal Clean Air Act.
   
   d. Information about the contractor, company, agents and type of equipment to be removed or installed including who perform the work and their EPA certifications must be on file at the UW Refrigeration Shop before work begins. Notification forms are at https://www.washington.edu/facilities/fstech/node/609.
   
   e. Spent refrigerants that cannot be reclaimed or recycled: these refrigerants are subject to all the applicable requirements of 173-303 WAC (Dangerous Waste Regulations) and must be treated as hazardous waste. UW EH & S Environmental Programs will handle such disposal.
   


8. Contaminated Ductwork - Not Used – Not in the Scope

   
   a. The purpose of the site-specific safety plan (SSSP) submittal and implementation is to inform workers of the unique characteristics of SARS-CoV-2 including common reference to the virus Covid-19 and to provide general guidelines for protecting workers, UW staff, visitors and the job site. As part of the scope the Contractor shall incorporate the best management work practice/s to prevent the spread of Covid-19 virus and execute the safe work practices on UW facilities including UWMC.
   
   b. The mitigation plan and work practice submitted should incorporate by reference and not limited (including all amendments) of the University of Washington’s Project Delivery Group Covid-19 prevention guidance document, UW PDG Covid-19 construction project site guidance, April 9, 2020 and the Department of Labor and Industries, Division of Occupational Safety and Health (DOSH), General Coronavirus Prevention Under Stay Home - Stay Healthy Order Updated. And subsequent amendments, extensions, and clarifications, including the Implementation of Phase 1 Construction Restart – Proclamation 20-25 Addendum (4/24/2020) and associated guidance (e.g. DOSH F414-164 and F414-162).
c. Submit SSSP Covid-19 for Owner review: Such plans should have the minimum guidelines such as a Covid 19 site supervisor, Covid 19 symptoms, worker Covid 19 safety training, infection prevention measure, social distancing, worker screening, engineering controls to prevent spread of virus, PPE, facial mask, sanitation and cleaning, employee health symptoms, reporting system for confirmed cases and corrective action such as contact tracing and decontamination and enhanced sanitizing of work areas, job hazard analysis if work task is within the 6 feet distancing and project documentation.

10. Silica and Fugitive Dust

a. Presumed silica-containing building materials such as in structural and finish assemblies of masonry walls and mortar, concrete slab (exterior walls, interior walls, floor, columns and ceiling assemblies), ceiling tiles and wallboard walls and ceiling assemblies are present in the areas of work. Silica controls and risk assessment shall apply during concrete floor grinding or preparation of new floor finish and new wall assembly’s installation.

b. Contractor is responsible for proper handling, removal, storage, and proper recycling of silica-containing materials according to all applicable regulation, employee and environment protection. Refer other section for engineering requirements for dust and particulate controls during all work including demolition activities.

c. Construction activities including but not limited to floor preparation, grinding, chipping, drilling, sawing, cutting and jack hammering and other general construction or demolition require control of potentially airborne silica dust from contaminating the environment within the facility. Impact of these building materials with detectable concentrations of silica shall be performed according to Washington Labor and Industries regulations for Silica in Construction (WAC 296-840 and -841 Airborne Contaminants) including all applicable employee exposure assessment.

d. All employers of personnel performing work related to the above are to address the following information related to all tasks to be performed by their personnel. Provide for Owner review Work Safety Plan or Job Hazard Plan to address Silica in building materials to be impacted, including: worker training, worker protection, personal protective equipment and engineering controls (to limit and control dust) to be implemented during the work, decontamination procedures, access restriction procedures and controlled/restricted areas, enclosures, debris clean-up procedures, worker exposure assessments and any related air monitoring.

11. Contaminated Soil Remediation – Not Used – Not in the Scope


PART 2 - PRODUCTS

2.1 MATERIALS

A. Not Used
2.2 EQUIPMENT

A. Not Used

PART 3 - EXECUTION

3.01 WORK PERFORMED BY ENVIRONMENTAL CONSULTANT

A. In addition to contractor’s ambient and personnel monitoring other necessary sampling such as post-remediation clearance, determination of hazardous and regulated materials or dangerous waste profiling for disposal may be performed by the Owner’s Environmental Consultant.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Installer: Company specializing in installing work of this Section and Certified in writing by the underlayment manufacturer and supplier.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete floor topping performance.

B. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 CONCRETE FLOOR UNDERLAYMENT

A. Factory-prepared and dry-packaged cementitious underlayment material capable of application from a feather edge to one half inch (1/2”) thickness over existing, prepared concrete floor slab.

   1. Basis of Design Product: Ardex ‘Feather Finish’

   2. Subject to compliance with requirements, other products by the following manufacturers:
      a. Mapei
b. CTS Cement Manufacturing Corp.
c. Or Approved Equal.

B. The material shall be hydraulic cement based, non-metallic with no added chlorides. It shall be pre-blended requiring only the addition of water.

2.2 RELATED MATERIALS

A. Primer: Manufacturer's recommended for concrete surfaces. Primer must be by same manufacturer as topping product.

2.3 MIXING

A. Floor Topping: Mix concrete floor topping materials and water according to manufacturer's written instructions. Do not overwater.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of concrete floor topping.

B. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D 4263.

C. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs. Remove contaminants from existing concrete that might impair bond of floor topping.

B. Thoroughly clean extraneous material such as dirt, loose chips, and dust from concrete surface. If compressed air is used, it shall be free of oil.

C. Concrete surface shall be saturated with potable water. Standing water shall be removed from surface to achieve a saturated-surface-dry (SSD) condition.

3.3 APPLICATION

A. Apply primer if required, mixed according to manufacturer's written instructions.

B. Start floor underlayment application in presence of manufacturer's technical representative.

C. Place underlayment continuously in a single layer, consolidating to achieve tight contact with bonding surface.
D. Level all areas to receive new Rubber Sheet Flooring with trowelable concrete underlayment material to produce a uniform and smooth substrate.

E. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.

3.4 REPAIRS

A. Defective Underlayment: Repair and patch defective concrete floor underlayment areas, including areas that have not bonded to concrete substrate as directed by Owner's Representative.

3.5 CURING

A. Cure installations per manufacturer’s recommendations.

3.6 CLEAN UP

A. Maintain a clean, orderly work area.

B. Clean excess material from surrounding areas immediately.

C. Protect adjacent surfaces that may be damaged, with drop cloths, waterproof paper, or other means to maintain surfaces free of material splashes, water, and debris.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Plastic-laminate finish casework.
   2. Solid-surfacing-material countertops.

1.2 DEFINITIONS

A. Interior architectural casework includes wood furring, blocking, shims, and hanging strips for installing casework items unless concealed within other construction before casework installation.

1.3 SUBMITTALS

A. Product Data: For solid surfacing and high-pressure decorative laminate, adhesive for bonding plastic laminate and finishing materials and processes, integral sinks.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, integral sinks and other components.
   1. Show details.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for equipment and other items installed in architectural casework.

C. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.
   2. Solid-surfacing materials, 6 inches (150 mm) square.

D. Casework Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

E. Qualification Data: For Installer and fabricator.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project.

B. Installer Qualifications: Fabricator of products.
C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural casework indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that casework, including installation, complies with requirements of grades specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver casework until painting and similar operations that could damage casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in Section 01 50 00 - “Temporary Facilities and Controls”.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where casework is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating casework without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural casework can be supported and installed as indicated.

1.8 WARRANTY

A. Provide manufacturer’s warranty against defects in materials.

B. Warranty shall provide material and labor to replace or repair defective materials and installations at the discretion of Owner.
PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of casework and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

C. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced caseworking standard. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
   4. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, 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 (3.2 m) beyond the centerline of the burners at any time during the test.
      a. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
      b. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
      c. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a caseworking shop certified by testing and inspecting agency.
      d. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated casework.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by casework quality standard.
   1. Manufacturers: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
      a. Wilsonart, Inc.
      b. Nevamar
      c. Formica
      d. Or Approved Equal
2. Colors and Patterns: As indicated in Drawings.

E. Solid-Surfacing Material: Homogeneous solid sheets or acrylic or polyester resin over continuous substrate complying with ISSFA-2 and NEMA LD3. Non-porous, no surface coating, laminated or of composite construction with through body colors capable of being worked and repaired using standard woodworking tools, meeting ANSI Z124.3 or ANSI Z124.6.

1. Basis of Design Product: Corian by DuPont or approved equal by one the following:
   a. Wilsonart Solid Surface
   b. Avonite

2. Colors and Patterns: As selected by Owner.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Wire Pulls: Basis of Design: Hafele 117.67.025 or approved equal brushed chrome pull, back mounted 5 inches (128 mm) center to center, 6 inches (153 mm) overall length; aluminum, silver matt anodized finish.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013; metal.

F. Door Locks: BHMA A156.11, E07121.

G. Drawer Locks: BHMA A156.11, E07041

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

C. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

D. Adhesive for Bonding Plastic Laminate: unpigmented contact cement.

E. Adhesive for Bonding Solid Surface Materials: Manufacturer’s standard one or two part adhesive kit to create inconspicuous, nonporous joints.

2.4 FABRICATION, GENERAL

A. Interior Casework Grade: Unless otherwise indicated, provide Custom-grade interior casework complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate casework to dimensions, profiles, and details indicated.

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of sealer.

2.5 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush overlay.

C. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

D. WI Door and Drawer Front Style: Flush overlay.

E. Reveal Dimension: 1/2 inch (13 mm).

F. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.

G. Materials for Semiexposed Surfaces:
   a. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As selected by Owner from laminate manufacturer's full range in the following categories:
      a. Solid colors, matte finish.
      b. Patterns, matte finish.

2.6 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Custom.

B. Solid-Surfacing-Material Thickness: 1/2 inch (19 mm).

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
   1. As selected by Owner from manufacturer's full range.

D. Fabricate tops in one piece, unless otherwise indicated. Top surface joints, where required, shall be flush. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   1. Fabricate tops with shop-applied edges of materials and configuration indicated.
   2. Fabricate and provide back and side splashes wherever counter edge abuts a vertical surface, unless noted otherwise.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition casework to average prevailing humidity conditions in installation areas.
B. Before installing architectural casework, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

A. Grade: Install casework to comply with requirements for the same grade specified in Part 2 for fabrication of type of casework involved.

B. Assemble casework and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install casework level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
   1. Install blocking in wall at cabinet locations as shown in Drawings or otherwise required.

D. Scribe and cut casework to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor casework to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with casework and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
   4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

H. Touch up finishing work specified in this Section after installation of work. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective work, where possible, to eliminate functional and visual defects; where not possible to repair, replace. Adjust joinery for uniform appearance.
B. Clean, lubricate, and adjust hardware. Clean exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

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

C. Qualification Data: For qualified Installer.

D. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A firm specializing in installing penetration firestopping similar in material, design, and extent to that indicated for this Project.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
      b. Classification markings on penetration firestopping correspond to designations listed by the following:

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.
1.5 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Hilti, Inc.
2. RectorSeal Corporation (The).
3. 3M; Fire Protection Products Division.
4. Tremco; Sealant/Weatherproofing Division.
5. USG Corporation.
6. Or Approved Equal

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Horizontal assemblies include floor/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.

   2. Temporary forming materials.


   5. 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 metallic sleeve lined with an intumescent strip, a radial extended 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 elastomeric sheet bonded to galvanized-steel sheet.

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

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.
J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping 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: Clean out openings immediately before installing penetration firestopping 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.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

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

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

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

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

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

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
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. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. 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 will engage a qualified testing agency to perform tests and inspections.

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

C. Proceed with enclosing penetration firestopping 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 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 is 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 and install new materials to produce systems complying with specified requirements.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparing sealant substrate surfaces.
B. Sealant and backing.

1.2 REFERENCES

B. ASTM C834: Specification for latex sealing compounds.
C. ASTM D 1622: Test method for apparent density of rigid cellular plastics.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data for each joint sealer product required, including instructions for joint preparation and joint sealer application.
B. Samples for Initial Selection Purposes: Submit manufacturer’s standard bead samples consisting of strips of actual products showing full range of colors available for each product exposed to view.
C. Submit Manufacturer’s Material Safety Data Sheet information and other instructions for the proper use of specified products to avoid adverse health and environmental effects.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section must have a minimum of three years’ experience manufacturing the product.
B. Warranty: The Contractor shall provide a two (2) year watertight warranty from the date of Substantial Completion for the work of this section.

1.5 DELIVERY STORAGE AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.
B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature change, contaminates or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealers when ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.
B. Provide notification to Owner fourteen (14) days prior to use of any sealants or other materials likely to cause odors or fumes.

C. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

PART 2 - PRODUCTS

2.1 GENERAL

A. General Sealant Performance Requirements:

1. Provide colors indicated or, if not otherwise indicated, as selected by Owner from manufacturer's standard colors.

2. Selected materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.

3. Where exposed to foot traffic, select materials of sufficient strength and hardness to withstand traffic without damage or deterioration of sealant.

2.2 ELASTOMERIC SEALANTS

A. One-Component Polyurethane Sealant (1PU-S):

1. Polyurethane based, one-part elastomeric sealant, complying with ASTM-C-920-79, Type S Grade NS (non-sag), Class 25, unless Grade P recommended by manufacturer for application shown.

   a. "Sonolastic NP-1" by Sonneborn,
   b. "Bostic 1000" by Bostic,
   c. "Dymonic" by Tremco
   d. Or Approved Equal.

B. One-Component Interior Silicone Rubber Sealant: (NpbMr-SR-S):

1. Silicone rubber-based, one-part elastomeric sealant, complying with ASTM-C-920-79, Type S, Grade NS, Class 25 and FS-S-001543, Class A. Provide Acid, nonporous-bond type, mildew-resistant silicone rubber sealant (NpbMr-SR-S) where both joint faces are metal, glass, plastic, tile or other non-porous material.

   a. "Omni-Plus" by Sonneborn,
   b. "Dow 8640" by Dow Corning,
   c. "G.E. 1702" by G.E.
   d. Or Approved Equal.

C. One-Component Acrylic-Emulsion Caulk (AcEm-C):

1. Acrylic-latex-rubber-modified base, one-part caulk, permanently flexible, nonstaining and nonbleeding and paintable; recommended by manufacturer for general interior exposure, complying with ASTM-C-834-76.
a. "Sonolac" by Sonneborn,
b. "Sikaflex 420" by Sika,
c. "Tremco Acrylic Latex" by Tremco
d. Or Approved Equal.

D. One-Component Butyl Caulk (Bu-C):

1. Butyl base, one-part caulk, solvent release, non-skinning, black color; recommended by manufacturer for concealed, interior building joints not exposed to touch.
   a. "BC 158" by Pecora,
   b. "Tremco Butyl Caulk" by Tremco,
   c. "Chem Calk 300" by Bostik
   d. Or Approved Equal.

E. One-Component Polyurethane Security Sealant (ST-PU):

1. Silyl-terminated polyurethane based, one-part tamper-resistant elastomeric sealant, complying with ASTM-C-920-98, Type S Grade NS (non-sag), Class 12.5.
   a. "DynaFlex SC" by Pecora Corporation
   b. "Sonoclastic Ultra" by Sonneborne Corporation
   c. Or Approved Equal.

2.3 MISCELLANEOUS MATERIALS

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. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material) Type B (bi-cellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Manufacturers:

1. Construction Foam Products; a division of Nomaco, Inc
2. Sonneborn
3. BASF Corporation – Construction Systems
4. Or Approved Equal.

D. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.

E. Bond Breaker Tape (BB-Tp): Polyethylene tape or other plastic tape as recommended by sealant manufacturer to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.
F. Bituminous Cane Fiber Joint Fillers (BF-JF):
   1. Provide resilient and non-extruding type premolded bituminous impregnated cane fiberboard units complying with ASTM D-1751, FS HH-F-341F, Type I and AASHTO 213.
      a. "All Cane Joint" by Edoco,
      b. "Horn Fiber Expansion Joint" by A.C. Horn
      c. 'Fibre Expansion Joint" by WR Meadows
      d. Or Approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on drawings and recommended by the manufacturer.
   B. Beginning of installation means Contractor accepts existing substrate.

3.2 PREPARATION
   A. Clean joints in accordance with manufacturer's instructions.
   B. Remove loose materials and foreign matter that might impair adhesion of sealant.
   C. Verify that joint backing and release tapes are compatible with sealant.
   D. Perform preparation in accordance with ASTM C804 for solvent release C790 for latex base sealants.
   E. Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION
   A. Install sealant in accordance with manufacturer's instructions.
   B. Measure joint dimensions and size materials to achieve required width/depth ratios.
   C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
   D. Install bond breaker where joint backing is not used.
   E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
   F. Install sealant free of air pockets, foreign embedded matter, ridges and sags.
   G. Tool joints concave.

3.4 CLEANING AND REPAIRING
   A. Clean work as recommended by product manufacturers and to Owner’s satisfaction.
B. Clean adjacent soiled surfaces.

C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished installation.

B. Protect sealants until cured.

3.6 SEALANT SCHEDULE

<table>
<thead>
<tr>
<th>Location</th>
<th>Required Sealant (2.02A-E)</th>
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<tbody>
<tr>
<td>1. Hollow Metal Work:</td>
<td>(1PU-S)</td>
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<tr>
<td>2. CMU:</td>
<td>(1PU-S)</td>
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<tr>
<td>3. GWB:</td>
<td>(AcEm-C)</td>
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<tr>
<td>4. Mechanical Penetrations:</td>
<td>(1PU-S)</td>
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<td>5. Wood to Metal:</td>
<td>(1PU-S)</td>
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<tr>
<td>6. Wood to Wood:</td>
<td>(1PU-S)</td>
</tr>
<tr>
<td>7. Plastic to Plastic:</td>
<td>(NpbMr-SR-S)</td>
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<tr>
<td>8. GWB to Plastic</td>
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<tr>
<td>or Plastic to Plastic in</td>
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<td>infection control areas</td>
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<tr>
<td>exposed to view:</td>
<td>(ST-PU)</td>
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</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.

1.2 DEFINITIONS

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

1.3 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.

1.4 QUALITY ASSURANCE

A. Conform to requirements of SDI-100, ANSI A151.1, NAAMM/HMMA 802-87 and other specifications named herein. Test reports shall be submitted upon request.

B. Qualifications:

1. Manufacturer: Manufacturers named in Part 2 of this Section with not less than 5 years’ experience in manufacturing commercial doors and frames of the type indicated.

2. Material Supplier:
   a. A recognized architectural hollow metal door and frame supplier who has been furnishing hollow metal in the same state as the project for a period of not less than 5 years.
   b. Hardware supplier’s organization shall include an experienced Certified Door Consultant (CDC), certified by the Door and Hardware Institute, who is available at reasonable times during the course of the work for consultation about the project’s opening requirements, to Owner, Architect and Contractor.
c. The Contractor shall use a hollow metal supplier who shall have warehousing facilities and an Underwriter’s Laboratories or Warnock Hersey approved fabrication shop for service to the Contractor during the Project, and for the warranty period. Supplier shall be a factory authorized distributor of all materials specified.

3. Installer: Company specializing in installing work of this Section and acceptable to the manufacturer and the door and frame supplier. Maintain regular work force of qualified personnel, trained, skilled, and experienced in installing doors, frames and door hardware if applicable, and constant, competent supervision.

1.5 REGULATORY REQUIREMENTS

A. Frames shall conform to applicable codes for fire ratings, egress and accessibility access. All interior vertical stairwell and exit corridor doors shall carry a minimum 450 degree temperature rise rating in addition to the required fire rating per the requirements of the currently adopted International Building Code (IBC) or Seattle Building Code (SBC).

B. Underwriters’ Laboratories and Warnock Hersey, labeled fire doors and frames:

1. All labeled fire doors and frames shall be of a type which has been investigated and tested in accordance with UL 10(c), ASTM E-152, NFPA 252, ANSI A2.2.

2. UL labeled doors and frames shall be manufactured under the UL factory inspection program and in strict compliance to UL procedures, and shall provide a degree of fire protection, heat transmission and panic loading capability indicated by the opening class.

3. A physical label or approved marking shall be affixed to the fire door or frame at an authorized facility as evidence of compliance and procedures of the labeling agency.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire resistance ratings.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and 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.

1.7 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Republic Doors and Frames
2. Ceco Corporation
3. Curries Corporation
4. SteeSlcraft
5. Or Approved Equal

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door 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 and temperature-rise limits indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. 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 according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches (44.5 mm).
      c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
      d. Edge Construction: Model 2, Seamless.
      e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
      f. Core: Manufacturer's standard.
      g. Fire-Rated Core: Manufacturer's standard core for fire-rated and temperature-rise-rated doors.
   2. Frames:
      a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
      b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
      c. Construction: Full profile welded.

2.3 HOLLOW-METAL PANELS

   A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

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 (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

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

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

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. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

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

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.6 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. 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. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. 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. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

4. Terminated Stops (Hospital Stops): Terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with [beveled] [square] stops unless otherwise indicated.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.

4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.
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 ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
   1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
   2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
   3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

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 doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

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

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
1. 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.
   
   a. 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.
   
   b. Install frames with removable stops located on secure side of opening.

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

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

4. Solidly pack mineral-fiber insulation inside frames.

5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
   
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

D. Grouting Frames: Not Allowed.

   
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
   
   3. Smoke-Control Doors: Install doors according to NFPA 105.

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

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner may engage a qualified inspector to perform inspections and to furnish reports to Architect.
B. Inspections:
   
   1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.

3.4 REPAIR

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.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-rated solid-core doors with wood veneer faces.
2. Factory finishing flush wood doors
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames” for hollow metal door frames.
2. Division 08 Section “Door Hardware” for door hardware
3. Division 08 Section “Glazing” for glass view panels in flush wood doors.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate doors to be factory finished and finish requirements.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors from single manufacturer.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.
B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

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

1. Failures include, but are not limited to, the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.


PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Western Oregon Door Company solid core doors or comparable product by one of the following:

1. Algoma Hardwoods, Inc.
2. Vancouver Door Company.
3. Approved equal.

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Heavy Duty.

C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, made with binder containing no urea-formaldehyde resin.
2. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
D. Structural-Composite-Lumber-Core Doors:

   a. Screw Withdrawal, Face: 700 lbf (3100 N).
   b. Screw Withdrawal, Edge: 400 lbf (1780 N).

2.3 SOLID CORE VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Solid core wood-faced door:
   1. Type: Interior door 20-minute labeled fire door or non-rated door.
   2. Grade: AWI Premium with grade ‘A’ face veneer
      a. Species: select white maple
      b. Cut: Plain (flat) sliced
      c. Match between veneer leaves: Slip match
      d. Assembly of veneer leaves on door faces: Balance match
      e. Room match: Door faces to be of compatible color and grain within each separate room
   3. Finish: factory-applied transparent finish
   4. Construction: 5-ply
   5. Core: Particle board grade 1-LD-2, 28-32 pcf; bonded to stiles and rails, sanded.
   6. Stiles: Minimum 2 inches structural composite lumber (SCL); provide ¼” minimum matching hardwood edge. Conceal crossbands.
   7. Rails:
   8. Bottom rail: 2 inches minimum
   9. Top rail: 2 inches minimum
   10. Lock blocks: Minimum 5 inches by 10 inches on lock side. Intermediate blocking to be installed for all panic hardware: minimum 5 inches deep.

2.4 LIGHT FRAMES

A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer’s standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Transparent Finish:

   1. Grade: Premium.
   2. Finish: AWI catalyzed polyurethane system.
   3. Staining: As selected by Owner from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

   1. Verify that 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 08 71 00 "Door Hardware"

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

   1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

   2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
      a. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
      b. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames for walls and ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

C. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

D. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

E. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Larsen's Manufacturing Company.
2. Acudor Products, Inc.
3. Babcock-Davis.
4. Milcor Inc.
5. Or Approved Equal.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
C. Flush Access Doors with Exposed Flanges:
   1. Basis-of-Design Product: Babcock-Davis B-UTK.
   2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer’s standard-width exposed flange, proportional to door size.
   3. Locations: Non-rated Walls and Ceilings where noted on Drawings.
   4. Door Size: 24 x 24 inches or as noted on Drawings.
   5. Uncoated Steel Sheet for Door: 14 gage
   7. Frame Material: 16 gage cold rolled steel, factory prime.
   9. Hardware: flush key

D. Fire-Rated, Flush Access Doors with Exposed Flanges:
   1. Basis-of-Design Product: Babcock-Davis B-ITK.
   2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer’s standard-width exposed flange, proportional to door size.
   3. Locations: Walls and Ceilings where noted on Drawings.
   5. Uncoated Steel Sheet for Door: 20 gage.
   7. Frame Material: 16 gage cold rolled steel, factory prime.
   9. Hardware: flush key

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
D. Frame Anchors: Same type as door face.
E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For key latches, furnish two keys per latch and key all latches alike.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Door and related hardware specified or indicated on drawings to complete project.
   2. Accessories, tools and fasteners required for installation and maintenance.
   3. Installation.

B. Related Sections:
   1. 08 11 13 - Hollow Metal Doors and Frames
   2. Division 26 Electrical Sections

C. Substitutions: Where allowed herein.

1.2 REFERENCES

A. Door & Hardware Institute (DHI):

B. Seattle Building Code, (SBC):

C. National Fire Protection Association (NFPA):

1.3 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):

A. Standard A156.18 “Materials and Finishes”.

B. Governing Codes: Where conflict occurs between above codes and standards the most stringent requirement governs.

1.4 DEFINITIONS

A. Tight-Fitting Door: Rated or non-rated door/frame assembly meeting the clearances in NFPA 80 and Part 3 of this Section.

1.5 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Provide hardware complying with NFPA 80 and IBC
2. Provide hardware listed by Underwriters’ Laboratories or other approved testing agency.
3. Hardware for fire-rated openings: Comply with NFPA 80.
4. Install hardware complying with Part 3.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 00 - Submittal Procedures.

B. Door Hardware Schedule & Format:

1. Submit 5 reproducible copies or PDF digital copy of schedule on 8-1/2 inch by 11 inch sheets numbered consecutively.
2. Furnish cover sheet listing name of project as shown on Contract Documents, name of Owner, name of Architect, name of Contractor, name of Architectural Hardware Consultant (AHC) and date of submittal or revision of submittal.
3. Furnish a vertical listing of hardware items used followed by manufacturer's name either on cover sheet or immediately following cover sheet. Example: "hinges - manufacturer's name". Also include a complete list and description of abbreviations used within the submittal.
4. Schedule hardware items for each door separately in typed vertical form; list each door in numerical order under a separate heading using door number in sequence as shown in door Opening Schedule. Note: Openings are scheduled following the numerical order of plan sheets.
   a. Do not group doors with like or similar hardware under a single heading. Multiple headings may occur on a submittal page provided all hardware, including the heading, can be listed without continuing onto another page.
   b. Completely describe each opening and show hardware symbols, as listed in door Opening Schedule, in margin opposite each item of hardware and describe each piece of hardware with specified manufacturer's numbers or their equivalents as approved for each item.
   c. Unless approved prior to bid, list only catalog numbers of named manufacturers on submittal.
   d. Hardware schedules not complying with above will not be reviewed and will be returned for proper formatting.
   e. Example of acceptable format:

   Heading 101
   One sgl dr 101 corridor 100 from Classroom 101 LHR 90
   3-0 x 7-0 x 1-3/4 WD x HM 20 min.

   3 ea  Hinges T4A3786-NRP 4-1/2 x 4-1/2  10B MC
   1 ea  Classroom Lock ML2055-CSR  10B CR
   1 ea  Closer PR7500  690 NO
   1 ea  Wall Stop WS02  10B MC
   1 ea  Kickplate KP50-HB4E 10 x 34  10B MC
   1 Set  Gasket S88D 17'  PE

   f. Owner will not be review hardware schedules unless first reviewed and approved by Contractor.
   g. Owner will review schedule and will return 1 copy to Contractor with comments.
   h. Approval of schedule does not relieve Contractor of providing hardware specified for project.
   i. Revise sheets having corrections and return updated copies for insertion into all distributed copies.
C. Other Submittals:
   1. Provide updated pages to keep current approved "Door Hardware Schedule". Provide a new title page accompanying new sheet(s), include a revision date. Mark each new page "Revised" or "REV" and date of revision.

D. Samples:
   1. Furnish samples on a timely basis upon request of Owner.
   2. Send samples to Owner.

E. Templates:
   1. Send hardware template information for plastic faced door, aluminum doors, metal doors and frames, together with a copy of approved hardware schedule to respective door and frame manufacturers or fabricators not later than 14 days after approval of schedule.
   2. Send templates for mounting magnetic wall holders to those installing electrical boxes and maintain consistent mounting locations throughout.
   3. Coordinate templates between manufacturers of different hardware items to allow installation of various hardware items without interference between items. Special templates may be necessary.
   4. Clearly indicate on templates under door clearances for exit devices, automatic flushbolts to ensure latching, and thresholds having built-in or applied stops.

F. Keying Schedule:
   1. Upon receipt of approved hardware schedule, arrange interview between hardware supplier and Owner, to obtain necessary keying information.
   2. Submit 3 copies of keying schedule indicating door numbers in numerical sequence, lock or cylinder number and its particular keying. Obtain approval before proceeding.

G. Contract Closeout Submittals:
   1. Comply with Section 01 77 00 – Closeout Procedures.
   2. Hardware Data & Maintenance Manuals: At time of acceptance of work, deliver two maintenance manuals. Include the following for each hardware item having operative parts:
      a. Table of contents.
      b. Catalog data.
      c. Isometric drawings, which identify and list, part numbers.
      d. Installation templates including special templates.
      e. Installation instructions.
      f. Manufacturer's maintenance instruction and maintenance schedule; include special lubricate and fluids information.
      g. Under separate section "Doors with Electric Hardware", include copy of door elevations, riser diagrams, and point-to-point wiring data identified by applicable door number. Include description of electric operation for each door or group of doors.
      h. Assemble data in a clearly identified 3-ring binder organized with tabs.
      i. Include in each manual one updated copy of hardware schedule, listing hardware installed, including changes and revisions approved by Owner during construction.
      j. Manufacturer’s written warranty covering specified time periods.
   3. Certifications: Arrange for hardware supplier to visit Site and certify following:
a. Hardware is installed and operating in a satisfactory manner.
b. Hardware installed is as listed on approved door hardware submittal, including changes and revisions approved by Owner during construction.
c. Submit certifications in writing addressed to Owner.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Contractor is responsible for:
      a. Proper application and fit of door and specialty hardware in locations as indicated on drawings or as specified.
      b. Items not specifically mentioned, but necessary to complete work are to be furnished matching in quality and finish of specified items in similar locations.
      c. Coordinate dimensions between hardware items.
      d. Furnish and install only hardware items listed on approved Door Hardware submittal.
   2. Contractor’s selection of hardware supplier:
      a. Select recognized builder’s hardware supplier who has been furnishing hardware in area of project for period not less than five years.
      b. Recognized supplier to have on staff an Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.
      c. Hardware supplier’s AHC to be available at all reasonable times during course of work to meet personally with Owner or Contractor for hardware consultation.
      d. Supplier willing to agree in writing to maintain parts inventory of items supplied for future service to Owner.

B. Pre-Installation Conference: Arrange for hardware supplier to meet with installer and discuss installation of hardware, templates and any unique hardware applications.

1.8 DELIVERY, STORAGE & HANDLING

A. Delivery: Package each item of hardware separately with necessary fasteners, screws, bolts, tampins, keys and installation templates. Deliver packages clearly identified with heading number as approved on hardware schedule.

B. Storage: Provide storage area for hardware, which is dry, secure, and complete with shelving and tables for unpacking and sorting.

1.9 WARRANTY

A. Special Warranties: Submit manufacturer’s standard written product warranty signed by manufacturer’s authorized official, guaranteeing to repair or replace defective products during following warranty periods:

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>WARRANTY PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>Life of Building</td>
</tr>
<tr>
<td>Mortise Locks</td>
<td>5 Years from date of Substantial Completion</td>
</tr>
<tr>
<td>Bored Locks</td>
<td>5 Years from date of Substantial Completion</td>
</tr>
<tr>
<td>Exit Devices (Mechanical)</td>
<td>5 Years from date of Substantial Completion</td>
</tr>
<tr>
<td>Door Closers (Mechanical)</td>
<td>10 Years from date of Substantial Completion</td>
</tr>
<tr>
<td>All other products</td>
<td>1 Year from date of Substantial Completion</td>
</tr>
</tbody>
</table>
B. Submit in accordance with Section 01 78 36 "Warranties".

1.10 MAINTENANCE

A. Tools:

1. After final adjustment of door hardware, turn over to Owner tools furnished during construction used for installation and adjustment.

2. Tag and identify each item as to its use and applicable piece of door hardware.

PART 2 - PRODUCTS

2.1 DOOR HARDWARE

A. General:


2. Door hardware items are specified from catalogs noted in this section. Only products, which are have UL10C listings will be acceptable on fire rated openings and will set standard for project.

3. Hardware items by other than named manufacturers will be reviewed for acceptance against specified items.

4. Except where scheduled otherwise, products within each hardware category are to be by one manufacturer, e.g. hinges, locks, closers, and exit devices.

B. Screws and Fasteners

1. All required screws shall be supplied as necessary for securing finish hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door closers where required by code and the appropriate blocking or reinforcing is not present in the door to preclude their use.

C. Hanging Devices

1. Hinges

a. Hinges shall conform to ANSI A156.1 and have the number of knuckles as specified, oil-impregnated bearings as specified with NRP (non-removable pin) feature, at all exterior reverse bevel doors. Unless otherwise scheduled, supply one (1) hinge for every 30” of door height (See * in hardware set). Hinge height 4 ½” for doors up to 36” wide, 5” for doors over 36” wide, or as recommended by the manufacturer.

1) Basis of Design: McKinney
2) Hager.
3) Stanley.

2. Continuous Hinges/Edge Guards

a. ANSI/BHMA Standard A156.26 Grade 1. 12-gauge, Hospital Tip

1) Basis of Design: Markar
2) McKinney
3) or Approved Equal.

D. Cylinders And Keying
1. **Cylinders**  
   a. All cylinders shall meet the requirements of UL437 including those for pick and drill resistance. Pick resistance shall incorporate two or more independent locking mechanisms including a pin tumbler device with six top pin chambers with mushroom shaped driver pins and a coded sidebar locking mechanism operated independently from the six top pin tumbler device. Drill resistance shall incorporate cylinder housing with fixed in-place case-hardened inserts to protect the pin tumbler shear line, cylinder plugs with case-hardened inserts to protect the pin tumbler shear line and the side bar, mushroom shaped stainless steel driver pins and stainless steel side pins. All cylinders shall be factory master keyed.  

2. **Keying**  
   a. All locks and cylinders shall be provided with construction cylinders, for use during the construction phase. All permanent cylinders shall be keyed to the existing Medeco M3 Master key system, per the approved key schedule. See Paragraph 1.6F. Provide the following quantity of keys:  
      1) Two (2) change keys per lock  
      2) Three (3) grand master keys  
      3) Six (6) master keys per master level  
      4) Five (5) construction/temporary keys  
   b. Master keys and all high-security or restricted keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink wrapped and imprinted to ensure the integrity of the packaging.

3. **Cylinder installation**  
   a. The general contractor shall install all construction cylinders/cores, at the time of hardware installation.  
   b. When requested by the Owner, the general contractor shall remove all construction cylinders/cores and install all permanent cylinders/cores. Construction cylinders/cores are to be returned to the hardware supplier.

E. **Locking Devices**  
   1. **Mortise locksets**  
      a. All locksets shall be ANSI 156.13 Series 1000, Grade 1 Certified. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. The lockset shall have a field-adjustable, beveled armored front, with a .125" minimum thickness and shall be reversible without opening the lock body. The lockset shall be 2 3/4" backset with a one-piece 3/4" anti-friction stainless steel latchbolt. The deadbolt shall be a full 1" throw made of stainless steel and have 2 hardened steel roller inserts. All strikes shall be non-handed with a curved lip. To ensure proper alignment, all trim, shall be thru-bolted and fully interchangeable between rose and escutcheon designs.  

2. **Lockset strikes**  
   a. Strikes shall be non-handed and available with curved lip, full lip or ASA type strikes as required. Provide strikes with lip-length required to accommodate jamb and/or trim detail and projection.

F. **Door Closers**  
   1. **Surface mounted closers – heavy duty**  
      a. All door closers shall be ANSI 156.4, Grade 1 Certified. All surface closers shall be of full rack and pinion construction. Closing speed, latching speed and
backcheck shall be controlled by key operated valves. Closers shall be non-handed to meet a variety of door conditions and design requirements.

G. Door Trim and Protective Plates

1. Kick plates shall be .050 gauges and 1-1/2 inches less full width of door, or as specified.
   a. Basis of Design: McKinney
   b. Rockwood
   c. or Approved Equal.

H. Door Stops and Holders

1. Wall mounted door stops
   a. Where a door is indicated on the plans to strike flush against a wall, wall bumpers shall be provided. Provide convex or concave design as indicated.
      1) Basis of Design: McKinney
      2) Rockwood
      3) or Approved Equal.

2. Overhead Stops and Holders
   a. Where specified, overhead stops/holders as shown in the hardware sets are to be provided. Track, slide, arm and jamb bracket shall be constructed of extruded bronze and shock absorber spring shall be of heavy tempered steel. Overhead stops shall be of non-handed design.
      1) Basis of Design: Rixson
      2) Sargent
      3) or Approved Equal.

3. Magnetic Hold-Opens
   a. Magnetic door holders shall meet or exceed ANSI A156.15 and be UL listed 228 for Door Closer and Holders, with or without integral smoke detectors. Holding force shall be 25 to 40 pounds and shall be fail-safe. Pushpin release that eliminates residual magnetism shall be standard. Provide magnetic hold-opens with triple-voltage coil that can receive 12 VDC, 24 VAC/DC, or 120VAC; or coordinate required voltage with electrical.
      1) Basis of Design: Rixson
      2) Sargent
      3) or Approved Equal.

I. Automatic Door Operators

1. Provide AccessOne Series 2100 Low Energy Electrohydraulic automatic swing door operator by KM Systems, Inc., Monroe, N.C. Installation to be performed by the local certified representative.
   a. No substitutions

2. Operator shall be electrohydraulic, completely self-contained with precision pump driven by a single phase 1/8 H.P. AC motor and high strength rack and pinion output. The totally enclosed operator shall be surface mounted above the door to the header or transom bar. The opening force shall be generated hydraulically and transmitted to the door through an arm linkage. Opening speed shall be fully adjustable and feature dual back check control allowing adjustment of both back check speed and position. Closing shall be by spring force generated by an internal compression spring. The single internal spring shall reduce manual opening force to not more than 15 lbf. Adjustable closing speed and latch speed shall control the door in the closing cycle. The pump shall include a safety release valve that prevents damage or malfunction
from excessive pressure. An adjustable limit switch shall interrupt power to the motor when the door reaches 90° full open. The door will remain in the open position by means of a continuous rated low current solenoid valve until the hold open time delay is satisfied. In the case of a power outage, the operator shall allow the door to be operated manually without damage to the operator or components.

3. The system shall include a solid state control providing adjustable hold open time (0 - 30 sec.), mode selector switch, and LED indication for activation signal, safety mat/sensor signal, and neon lamp indication for operator power. Mode selector will provide three operational modes:
   a. Timer Mode: Door remains in the open position until the preset hold time expires,
   b. Ratchet Mode: Door remains in the open position until it receives a second activation signal. After receipt of second activation signal, door closes.
   c. Ratchet with Time-out Mode: Door remains in the open position until it receives a second activation signal. After receipt of a second activation signal, door closes. If the second signal is not received within 60 seconds, control will time out and allow door to close.

4. Operator control shall include a standard three position switch with functions for ON, OFF, and HOLD OPEN. Operator shall be capable of remaining in the hold open position for extended periods of time without damage to the operator or components.

5. Operator shall be completely self-contained within an enclosure formed by a ¼” structural aluminum backplate (alloy 6061-T6) and an 5-11/16” x 5-7/8” extruded aluminum cover (alloy 6063-T6). Cover shall be removable and allow full access to the operator without removing the operator from the backplate. Cover shall be integral color anodized/painted to match adjacent storefront/frame finish:
   a. 204-R1 Clear

6. Activation Devices: Opening cycle shall be activated by touchless switch. Switches shall be installed in a standard 2-gang electrical wall box provided by the electrical contractor and placed in a location in compliance with ANSI A117.1.
   a. U-WAV Touchless Switch by Larco
   b. Approved equal

J. Gasketing And Thresholds

1. Provide continuous weatherseal on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide intumescent seals as required to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

K. Silencers

1. Furnish rubber door silencers all hollow metal frames; two (2) per pair and three (3) per single door frame.

2.2 FINISHES

A. Provide hardware, including exposed fasteners, attachments, and accessory items, in the finish listed in the hardware set, except as noted otherwise in this section.
B. ANSI Finishes: Hardware submittals using ANSI finish equivalents will be accepted.

C. Provide all lockset/latchset lever trim, exit device push rail and trim, and all push/pull units with MicroShield antimicrobial coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify frames are plumb and doors are ready to receive work, and dimensions are as indicated on shop drawings or as instructed by manufacturers.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. General:

1. Install each hardware item in accordance with each manufacturer's instructions and recommendations.
2. Install no hardware until substrate finishes are complete.
3. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or otherwise finished, install each item completely then remove and store during application of finishes; reinstall upon completion of finishing operations.
4. Set items level, plumb, and true to line and location.
5. Adjust and reinforce attachment substrate as necessary for a secure installation.
6. Drill and countersink items not factory prepared for fasteners.
7. Space fasteners and anchors per manufacturer's instructions and in accordance with industry standards.
8. Do not install hardware on doors, which have been improperly prepared.
9. Attach wall mounted hardware to concealed wall blocking. Do not install wall-mounted hardware where wall blocking has not been installed and arrange for blocking to be installed before proceeding.

B. Installation Clarification: Direct questions regarding placement of hardware to Owner for clarification prior to installation.

C. Fire-rated Openings:

1. In addition to previous requirements, conform to NFPA 80 and IBC covering installations of fire door assemblies.
2. Refer to instructions from door and frame manufacturers regarding special hardware installation requirements, including function holes, undercutting and minimum clearances between hardware cutouts.

D. Acceptable Installation:

1. Install doors and frames plumb.
2. Clearances:
   a. Rated and Non-Rated Doors:
1) Wood Doors: 1/8 inch maximum, 1/16 inch minimum, clearance between door and frame and along meeting edges. When installed clearances between door and frame, including meeting edges are to be equal.

2) Metal Doors: 1/8 inch plus 1/16 inch maximum tolerance between door and frame and along meeting edges. Installed clearances between door and frame, including meeting edges are to be equal, but not less than 1/16 inch between the door and frame.

b. Under Door Maximum Clearances at Rated Doors:
   1) 3/4 inch to concrete or ceramic tile.
   2) 5/8 inch to rigid tile (vinyl or sheet vinyl).
   3) 1/2 inch to top of carpet.
   4) 3/8 inch to top of noncombustible sill or threshold.
   5) Exceptions: Where exit device templates indicate reduced clearances comply with most stringent lesser dimensions.

3. Astragals: Must lie flat against opposing door face for entire height of door.

4. Do not proceed with additional hardware installation until above clearances have been met.

E. Installation Templates, Instruction Sheets, and Schedules: Retain copies of templates, instruction sheets, schedules, installation details and similar data regarding hardware, maintenance and servicing. See Part 1 under Contract Close-out Submittals for assembly and distribution of data.

F. Locations: Unless otherwise indicated on drawings or listed below, locate hardware in accordance with DHI recommended locations. Mount each hardware type at same location regardless of door material.

G. Hardware & Specialties: In addition to installation requirements specified above, install hardware as follows.

1. Hinges:
   a. Hang doors within following tolerances: 1/8" maximum between door and frame, and 1/8" maximum between meeting edges of pairs of doors.
   b. Provide under door clearance at fire-assemblies per NFPA 80.
   c. Where shimming is necessary for proper door/ frame installation, use only metal shims.
   d. Install hinges flush with frame rabbets and edge of doors.
   e. Drive hinge pin flush with top of hinge barrel after doors are hung plumb.
   f. Install electric hinges or pivots as center hinge or second hinge from bottom where doors have 2 pairs of hinges.
   g. Doors with spring hinges: Conform to adjustment requirements for closers.

2. Locks: Install only curved lip strikes and a dust box behind each strike.
   a. Install locks 40/1/4 inches above finished floor. This will establish the lever height throughout the project. Coordinate electric strike locations so all levers are mounted same height throughout the project.
   b. Install only curved lip strikes and install a dust box behind each strike. Grout box in frame not acceptable as equivalent to a dust box.
   c. Pairs of doors with cylindrical locks: Install protective back strikes except at doors with overlapping metal astragals.

3. Closers:
   a. Install closers to permit maximum degree of door swing allowed by job conditions. Follow manufacturer’s instructions.
b. Do not install parallel arm closers until after weather-stripping or seals have been installed on head frame.

4. Door Stops:
   a. Install stops to permit maximum degree of door swing allowed by job conditions.
   b. Locate floor stops so as not to create a tripping hazard, and to catch door at a point 6 inches in from latch edge, but in no case further than 1/3 door width measured from.
   c. Locate projecting wall stops 80 inches above finished floor with sloped edge on top.
   d. Wall stops intended for knobs and levers are to be located centered on spindle. Do not install stops having concave bumpers when convex bumpers are scheduled.

5. Doorplates (Kick Plates):
   a. Armor and kick plates: Install on push side of single acting doors.
   b. Mop plates: Install on pull side of single acting doors.
   c. Drill pilot holes for fasteners prior to installing plates on plastic laminate faced doors.
   d. When plates have bevels on 3 sides mount flat edge facing floor.

6. Weather-stripping (Seals & Gaskets):
   a. Install per manufacturers' instructions.
   b. Do not cut or interrupt extrusions for weather stripping, seals or gaskets for a door closer accessory, i.e. soffit shoe.
   c. Contact hardware supplier when a conflict arises for alternate method of attachment, including templates, and obtain approval from Owner prior to installation.

H. Miscellaneous Hardware:

1. Component Gasket System for “S” Label:
   a. Follow door and/or frame manufacturer's “Installation Instruction”.
   b. Retain copy of instructions for inclusion into 3-ring closeout binder. See Part 1 this Section.
   c. Install gasket system on a single and pair of doors, and obtain approval from Owner before proceeding. Approval will be based on a demonstration doors close and latch smoothly without latchbolt bind, and review of installation instructions.

3.3 FIELD QUALITY CONTROL:

A. Tests: Magnetic Release Door Holders: Test each magnetic release after installation and note holding force. Magnetic holders, which do not have 25-pound minimum holding force, are to have voltage checked at each holder, and condition corrected.

B. Manufacturer's Field Service:

1. Closers: After air-handling system has been balanced, arrange for closers to be finally adjusted by person trained by closer manufacturer or closer manufacturer's representative.
   a. Adjust closers so doors take 3 seconds minimum to swing from a 70-degree open position to a point 3” from latching.
   b. Adjust closers not to exceed following opening forces:
3.4 ADJUSTING

A. Adjust and check each item of hardware and each door, to insure proper operation and function of each unit.

B. Lubricate moving parts with graphite-type lubricant, unless otherwise recommended by manufacturer.

C. Replace hardware, which cannot be lubricated and adjusted, to operate freely and smoothly.

D. Final Adjustment:
   1. Whenever hardware installation is made more than 1 month prior to acceptance of Work, make final adjustment and check of hardware during week immediately prior to acceptance, unless otherwise directed by Owner.
   2. Clean and relubricate operating items as necessary to restore proper functioning and finish of hardware and doors.
   3. Make final adjustment of locksets and closers to compensate for operation of heating and ventilating systems under supervision of manufacturer’s representative.

3.5 PROTECTION AND CLEANING

A. Installed Hardware:
   1. Protect Hardware against damage.
   2. Remove protective coverings from hardware after surrounding surfaces have received final painting or refinishing and room or area is ready for final inspection.
   3. Replace damaged hardware units and units which cannot be refinished to the Owner’s satisfaction.

B. Installed Doors:
   1. Do not prop doors open using any item wedged between hinge jamb and door.
   2. Use only rubber stops, cardboard or rope.
   3. Do not use unprotected wood wedges under wood doors.
   4. Do not use bare wire or other unprotected means of securing doors in open position, which may damage or mar the finish of door or hardware.

C. Job Acceptance: Prior to acceptance of job clean hardware surfaces on both interior and exterior doors of mortar, plaster, paint, caulking and other contaminants. Replace hardware damaged after installation or where finish cannot be restored after cleaning.

3.6 DEMONSTRATION

A. Instructions: Provide instruction in operation and maintenance of key control system. See Part 2 Paragraph 2.1 – D.2 for requirements.

3.7 DOOR HARDWARE SCHEDULE: BASIS OF DESIGN

A. Manufacturer’s abbreviations:
   1. HS    HES
   2. LA    Larco
   3. LCN   LCN
   4. MKHR  Markar
5. MK McKinney
6. MD Medeco
7. PEMK Pemko
8. RIX Rixson
9. SA Sargent
10. SCHL Schlage
11. SU Securitron
12. TR Trimco

Hardware Group: 1
Door 1004B1, BB314C, 3'-0" x 7'-0" x 1-3/4" WD/HMF (NR)

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>HINGE T4A3786</td>
<td>MK</td>
</tr>
<tr>
<td>1</td>
<td>LOCKSET 8255 LNL (OFFICE)</td>
<td>MK</td>
</tr>
<tr>
<td>1</td>
<td>CYLINDER 10T0200</td>
<td>MD</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING S88D20 PEMK</td>
<td>PEMK</td>
</tr>
</tbody>
</table>

Hardware Group: 2
Doors 1004B, 1004C 4'-0" x 7'-0" x 1-3/4" HMD/HMF (NR)

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Manufacturer</th>
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<tbody>
<tr>
<td>1</td>
<td>CONTINUOUS HINGE HG-305 CTP</td>
<td>MKHR L</td>
</tr>
<tr>
<td>2</td>
<td>POWER TRANSFER EL-EPT SECR</td>
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<tr>
<td>1</td>
<td>OVERHEAD STOP 1-336- 90 DEGREE (CONCEALED) RIX</td>
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</tr>
<tr>
<td>2</td>
<td>KICKPLATE K1050 B4E CSK ROCK</td>
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<tr>
<td>1</td>
<td>GASKETING S88D20 PEMK</td>
<td>PEMK</td>
</tr>
<tr>
<td>2</td>
<td>DOOR POSITION SWITCH 1078 SENO</td>
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<tr>
<td>1</td>
<td>CARD READER UWMC STANDARD</td>
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<td>1</td>
<td>INTEGRATE WITH EXISTING CARD SYSTEM</td>
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</tr>
</tbody>
</table>

Notes: Door is normally closed and locked. Exterior access by presenting valid credential to wall-mounted reader. Free egress at all times.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Glass for windows, doors, and interior storefront glazing.
   2. Glazing sealants and accessories.

B. Related Requirements:
   1. Section 08 14 16 – Flush Wood Doors
   2. Section 08 11 13 – Hollow Metal Doors and Frames

1.2 DEFINITIONS

A. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.


C. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

A. Comply with requirements of Section 01 33 00 'Submittal Procedures'.

B. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association’s Certified Glass Installer Program.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 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.

B. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.9 WARRANTY

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pilkington North America

B. Cardinal Glass Industries

C. Or Approved Equal

D. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

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 the following: 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. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

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. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) to match existing building materials, Quality-Q3.

2.5 GLAZING SEALANTS

A. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

C. Glazing Sealant: One-part RTV silicone glazing sealant complying with Federal Specification TT-S-001543, Class A • Federal Specification TT-S-00230, Class A.

D. Basis of Design Product: Dow Corning 999-A Silicone Glazing Sealant

1. Or Approved Equal.

2. Applicable Standards:
   a. ASTM C 679 Tack-Free Time at 25°C (77°F), 50% RH 10 – 20 minutes. Tooling Time 5-10 minutes.
   b. ASTM C 639 Flow, Sag or Slump Nil Color Clear,

E. Colors of Exposed Glazing Sealants:


2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 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. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

C. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

1. Presence and functioning of weep systems.

2. Minimum required face and edge clearances.

3. Effective sealing between joints of glass-framing members.
C. 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 (1270 mm).

G. 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.

H. Provide 1/8-inch (3-mm) 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.

I. 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 according to requirements in referenced glazing publications.

J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 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. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

C. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

D. Remove and replace glass that is damaged during construction period.

E. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 MONOLITHIC GLASS SCHEDULE
A. Glass Type [GL-1]: Clear fully tempered float glass.

1. Minimum thickness at door lights and relites: 1/4 in. (6 mm).

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Framing metal studs for interior partitions, 20 gauge and lighter.
   2. Resilient channel and furring.
   3. Interior gypsum board and finishing systems.

1.2 DESIGN REQUIREMENTS

A. Fire-Resistance Ratings: Provide gypsum drywall construction having fire-resistance ratings indicated.

B. Conform to assemblies tested per ASTM E 119 by inspecting and testing organization acceptable to authorities having jurisdiction.

C. Structural Performance of Interior Partition Systems:
   2. Deflection Limit:
      a. For Brittle Finishes: 1/240 of span.
      b. For Gypsum Wallboard Finishes: 1/180 of span.
      c. For Flexible Finishes: 1/120 of span.

D. Sound Transmission Classes (STC):
   1. Untreated Interior Partition: 35 minimum.
   2. Sound Partition: 45 minimum.

1.3 SUBMITTALS

A. Comply with requirements of Section 01 33 00 “Submittal Procedures”.

B. Certification: Submit UL, WHI, or other listing of fire rated assemblies, identifying products being provided.

C. Product data.

1.4 QUALITY ASSURANCE

B. Thickness of metal framing components is specified by decimal thickness as currently favored by steel industry trade associations. (Refer ASTM A 525.)
   1. Specified metal thickness is minimum acceptable for base metal, uncoated, unless specifically indicated as Manufacturer's design thickness.
   2. Gauge references are for convenience only and shall not be used to imply an acceptance of base metal thinner than the decimal thickness specified.

C. Fire rating requirements take precedence over construction requirements indicated. In event of conflict, notify Owner's Representative and do not proceed in area of conflict until resolved.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original and unopened packages, containers, or bundles, with brand names and manufacturer's labels intact and legible.

B. Store materials in dry location, fully protected from weather and direct exposure to sunlight.

C. Stack gypsum board products flat and level, properly supported to prevent sagging or damage to ends and edges.

D. Store corner bead and other metal and plastic accessories to prevent bending, sagging, distortion, or other mechanical damage.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.
   1. For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry.
   2. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.
   3. Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Steel Framing and Furring:
   1. Cemco, Inc.
   3. Steeler
4. Or Approved Equal.

C. Gypsum Board:

1. Domtar Gypsum Co.
2. Georgia-Pacific Corp.
4. United States Gypsum Co.
5. Or Approved Equal.

D. Acoustical Gypsum Board:

1. CertainTeed
2. Pabco Gypsum
3. Or Approved Equal.

2.2 STEEL FRAMING FOR WALLS AND PARTITIONS

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: As indicated on Drawings
2. Depth: As indicated on Drawings
3. Slip-Type Head Joints: Where indicated, provide one of the following:
   a. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
   b. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
   c. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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

1. Minimum Base-Metal Thickness: As indicated on Drawings.

C. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: 1-1/2 inches (38.1 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm) thick, galvanized steel.

D. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.

2.3 GYPSUM BOARD

A. Provide gypsum board in maximum lengths available to minimize end joints. Thickness, 5/8 inch unless otherwise indicated.

   1. Non-rated Assemblies: Regular Type.
   2. Fire Rated Assemblies: Type X.

C. Gypsum Backing Board for Multi-Layer Applications: ASTM C 442 or A 36.
   1. Non-rated Assemblies: Regular Type.
   2. Fire Rated Assemblies: Type X.

D. Gypsum Acoustical Wallboard:
   1. Thickness: 1/2” (12.7mm), tapered edges
   2. Width: 4’ (1220mm)
   3. Lengths: 8’ (2438mm), 9’ (2743mm), 10’ (3048mm), 12’ (3658mm)
   4. Weight: 2.13 lbs./sq. ft.
   5. STC-rated Assemblies (per ASTM E90): 47-52
   6. Flame Spread (per ASTM E84): Class A
   7. Product Standards: C1766
   8. Installation Standards: ASTM C840; GA-214, GA-216

2.4 ACOUSTICAL PUTTY

A. Moldable Acoustical Putty: Basis of Design Product: Quiet Putty by Pabco Gypsum. Non-toxic, non-skinning pads with STC rating: 47-63 (ASTM E90) or approved equal by one the following:
   1. Acoustical Solutions
   2. ATS Acoustics
   3. CertainTeed
   4. or Approved Equal

2.5 TRIM ACCESSORIES

A. ASTM C 840, Manufacturer’s standard trim accessories, including corner bead and edge trim of beaded type with face flanges for concealment in joint compound except where semi-finishing or exposed type is indicated.

B. Provide corner bead formed from zinc alloy.

C. Provide one-piece control joints with 1/4 inch wide by 7/16-inch deep V-shaped slot, covered with removable tape, of roll-formed zinc or extruded vinyl as recommended by gypsum board Manufacturer.
2.6 GYPSUM BOARD JOINT TREATMENT MATERIALS

A. ASTM C 475 and ASTM C 840, complying with recommendations of Manufacturer of both gypsum board and joint treatment materials for application indicated.

B. Joint Tape: Paper reinforcing tape, unless otherwise indicated. Use open-weave glass fiber tape where recommended by gypsum board Manufacturer with use of setting-type joint compound.

C. Setting-Type Joint Compound: Factory-prepackaged, job-mixed chemical-hardening powder products formulated for uses indicated.

D. Drying-Type Joint Compounds: Factory-prepackaged, vinyl-based products:
   2. All-purpose compound formulated for use as both taping and topping compound.

2.7 MISCELLANEOUS MATERIALS

A. Provide auxiliary materials for gypsum board construction which comply with referenced standards and recommendations of gypsum board Manufacturer:

B. Laminating Adhesives: Product recommended for laminating gypsum boards.

C. Gypsum Board Screws: ASTM C 1002.

D. Concealed Acoustical Sealant: Nondrying, nonhardening, nonskinning, nonstaining, nonbleeding, gunnable sealant as specified in Section 0 7 92 00 - Joint Sealants.

E. Sound Attenuation Blankets:
   1. Cavity and Non-plenum Blankets: creased mineral wool insulation assemblies complying with ASTM C 665, for Type I.

F. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board construction attaches or abuts, preset hollow metal frames, structural framing, and other items affecting installation.

B. Verify conditions are acceptable and ready to receive gypsum board assemblies.
3.2 STEEL FRAMING INSTALLATION

A. Install steel framing to comply with ASTM C 754 and ASTM C 840.

B. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement:
   1. Where edges of suspended ceilings abut building structure at ceiling perimeters and at penetrations of structural elements.
   2. Where partition and wall framing abuts overhead structure.

C. Do not bridge building expansion and control joints with steel framing or furring members. Frame both sides of joint with steel framing or furring members or as indicated.

D. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

E. Secure hangers to structural support by connecting directly to structure where possible. Otherwise connect to inserts, clips, other anchorage devices or fasteners as indicated.

F. Do not connect or suspend steel framing from ducts, pipes or conduit. Maintain 2 inches clearance to hangers and braces.

G. Provide indirect-hung metal support system with carrying channels (main runners) spaced 4 feet o.c., hangers 4 feet o.c. along runners, and rigid furring members 16 inches o.c., unless otherwise indicated.

H. Install direct-hung grid suspension system, including perimeter wall track or angle, with members spaced and installed to comply with Manufacturer’s instructions.

I. Install runner tracks at floors, ceilings and structural walls and columns. Where studs are installed directly against exterior walls of masonry or concrete, install asphalt felt strips between studs and wall.

J. Extend partition framing full height to structural supports above suspended ceilings, except where indicated otherwise.
   1. Continue framing over frames for doors and other openings.
   2. Frame around ducts to provide support for gypsum board.

K. Install steel studs at 16 inches on center except where otherwise indicated or required.

L. Frame door and other openings with studs and runners of the proper gauge, number and arrangement to comply with Manufacturer’s recommendations for size of opening, weight and height of doors, and stud size, unless otherwise indicated.

M. Install supplementary framing, blocking and bracing at openings and terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings and similar construction to comply with details indicated and with recommendations of gypsum board Manufacturer.
N. Resilient channel:

1. Install acoustical mineral wool sound attenuation blankets within the stud cavity vertically and hold in place with resilient channel spaced 24 inches (610 mm) o.c.
2. Securely attach narrow flanges of resilient channel to wall framing with narrow flange at bottom to allow weight of gypsum board to draw itself away from framing.

O. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.3 GYPSUM BOARD INSTALLATION

A. Install and finish gypsum board to comply with ASTM C 840.

B. Install gypsum board to metal supports in accordance with GA 216 and fire rated assembly requirements.

C. Install sound attenuation blanks where indicated, without gaps and with support where necessary to prevent movement or dislocation.

1. Locate behind and around electrical and mechanical items within or behind partition and tight to items passing through partitions.
2. Lay sound attenuation blankets over ceiling construction adjacent and parallel to sound insulated partitions and STC rated operable partitions. Extend blankets out 24 inches each side.
3. Cavity and Non-plenum Blankets: mineral wool insulation complying with ASTM C 665, for Type I.

D. Install acoustical sealant around perimeter of acoustically insulated partitions. Apply continuous bead at each side of framing member interface with substrates. Seal all penetrations.

E. Install board panels to minimize number of abutting end joints or avoid them entirely. Stagger abutting end joints of adjacent panels not less than one framing member.

F. Position adjoining panels so that tapered edges abut tapered edges and field-cut edges abut field-cut edges and ends. Avoid joints at corners of framed openings.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Isolate drywall construction from abutting structural and masonry work. Provide edge trim and sealant as recommended by Manufacturer.

I. Do not bridge building expansion or control joints. Leave space of the width indicated between boards, and trim both edges for installation of sealant or gasket.

J. Double Layer Application:
1. Fasten first layer to resilient channels with $\frac{1}{2}"$ at 6" o.c. Do not allow screws to contact metal studs.
2. Install second layer perpendicular to first.

3.4 INTERIOR GYPSUM BOARD FINISHES

A. Definitions: Specified levels of finish represent finishes described in consensus document entitled Recommended Specification: Levels of Gypsum Board Finish, as published by AWCI, CISCA, GA, and PDCA.

B. Level 0 Finish: No taping, applied trim accessories, or finishing required.

C. Level 1 Finish:

1. Embed joint tape in joint compound at gypsum board joints and interior angles.
2. After joint treatment, remove excess joint compound from gypsum board surfaces.
3. Apply trim accessories in corridors and other occupied areas.

D. Level 2 Finish:

1. Embed joint tape in joint compound at joints and interior angles.
2. Apply separate coat of compound over joints, angles, fastener heads, and accessories.
3. Remove excess joint compound from gypsum board surfaces.

E. Level 3 Finish:

1. Embed joint tape in joint compound at joints and interior angles.
2. Apply two separate coats of compound over joints, angles, fastener heads, surface defects, and trim accessories.
3. Finish joint compound smooth and free of tool marks and ridges.
4. Remove excess joint compound from gypsum board and leave prepared surfaces ready to be coated with primer/sealer prior to application of final finishes.

F. Level 4 Finish:

1. Embed joint tape in joint compound at joints and interior angles.
2. Apply three separate coats of compound over joints, angles, fastener heads, surface defects, and trim accessories.
3. Finish joint compound smooth and free of tool marks and ridges.
4. Remove excess joint compound from gypsum board and leave prepared surfaces ready to be coated with primer/sealer prior to application of final finishes.

G. Level 5 Finish:

1. Embed joint tape in joint compound at joints and interior angles.
2. Apply three separate coats of compound over joints, angles, fastener heads, surface defects, and trim accessories.
3. Finish joint compound smooth and free of tool marks and ridges.
4. After joint treatment, apply skim coat of joint compound, or a material manufactured especially for this purpose, over exposed interior gypsum board surfaces.
5. Sand lightly and leave prepared surfaces ready to be coated with primer/sealer prior to application of finish paint.

3.5 SCHEDULE OF INTERIOR FINISHES

A. Level 0 Finish  Not Used
B. Level 1 Finish  Areas above ceiling, not exposed to view.
C. Level 2 Finish  Not Used.
D. Level 3 Finish  Not Used.
E. Level 4 Finish  Surfaces to receive flat paints, matte, eggshell and semi-gloss finishes.
F. Level 5 Finish  Not Used.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exposed suspension system.
2. Trim and accessories.
3. Acoustical lay-in panels.

1.2 DEFINITIONS

A. CSTC (Ceiling Sound Transmission Class): The numerical rating of sound attenuation for the ceiling system between two rooms when installed over a barrier with a common plenum above and tested in accordance with AMA-I-II-1967.

B. LR (Light Reflectance Coefficient): As determined by ASTM E 1264.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit data for each distinct suspension system and acoustical unit type indicated in accordance with Section 01 33 00 – Submittal Procedures. Include ceiling panels, suspension systems, insulation and seismic restraint.

C. Samples: Submit the following:

1. Verification samples:
   a. Acoustical units: 12-inch-square samples of each type required.
   b. Exposed suspension and trim elements: 12-inch-long samples of each type and finish required.

D. Coordination Drawings: Submit reflected ceiling plans showing correlations as necessary between work of this section and work of other sections.

1. Minimum drawing scale: 1/4 inch equals 1 foot.
2. Show the following:
   a. Ceiling suspension elements.
   b. Hanger type and method of attachment to structure.
   c. "Required Accessible Ceiling Tile" locations.
   d. Light fixtures.
   e. HVAC equipment, including maintenance clearances.
   f. Fire suppression system components.
   g. Loudspeakers.
   h. Partitions.
   i. Cable trays.
E. Shop Drawings: Submit shop drawings showing location of main runners and cross tees, perimeter conditions, lighting fixtures, ventilation fixtures, and other items which penetrate the ceiling.

1. Drawings shall list materials, dimensions, method and spacing of vertical and lateral hanger wires, methods of supporting ceiling where ducts or other work interfere, and other pertinent information.

2. Show method of resisting horizontal forces required by the International Building Code for seismic zone of project.

F. Availability Requirement Statement: Submit statement from manufacturer’s verifying that ceiling panel types shown in documents will be readily available for up to ten years.

1.4 QUALITY ASSURANCE

A. Fire Performance Characteristics:

1. Surface burning characteristics: Provide products having the following characteristics when tested in accordance with ASTM E 84:
   b. Maximum smoke developed: 50.

B. Seismic Restraint: Design and construct seismic restraint system for suspended metal grid in accordance with IBC/SBC 2015.

1.5 PROJECT CONDITIONS

A. In a timely manner, furnish to affected installers, attachment devices for incorporation into other work.

B. Coordination Data: Prepare and distribute to affected installers, data necessary for coordination with related work. Include setting diagrams showing placement of attachment devices for acoustical ceiling hangers.

C. Coordinate ceiling system installation with work of other sections as required, including the following:

1. Light fixtures.
2. HVAC equipment.
3. Fire suppression system components.
4. Loudspeakers.
5. Partitions.
6. Cable trays.
7. Ceiling mounted medical equipment.
8. Changes in plane, furring, etc.

D. Within each space to receive specified products, do not begin installation until the following conditions are met:

1. Work above ceilings has been finished, tested, and approved.
2. Space to receive ceiling system is properly enclosed and protected from weather.
3. Any wet work within the space is dry.

E. Do not begin installation of ceiling system until building’s normal operating temperature and humidity levels have been reached and will be maintained.
1.6 MAINTENANCE

A. Extra Materials: After ceiling installation has been completed, deliver to the Owner replacement materials for materials installed. Furnish products that precisely match installed products. Protect with appropriate packaging and provide clear, legible labels.

1. Acoustical lay-in panels: Furnish full-sized panels in quantities not less than 1 percent of quantity of panels installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Armstrong World Industries. Subject to compliance with requirements products that may be incorporated into the Work include:

1. USG Corporation.
2. CertainTeed.
3. Chicago Metallic.
4. Or Approved Equal

2.2 ACOUSTICAL CEILING UNITS – GENERAL

A. Standard for Acoustical Ceiling Units: Provide units conforming to applicable requirements of ASTM E 1264 for Class A materials.

B. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard 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 and evaluated according to ASTM D 3274 or ASTM G 21.

2.3 CEILING SUSPENSION SYSTEMS – GENERAL

A. Provide suspension systems conforming to specified requirements and to requirements of ASTM C 635, 2009 IBC, ASCE 7-02, and CISCA standards. Exposed pop rivets may not be used.

B. Colors: Provide indicated colors. Where color is not indicated, provide colors as selected by the Owner from manufacturer's complete set of standard colors.

C. Finishes: Manufacturer's standard shop-applied finishes.

D. Attachment Devices for Suspension System:

1. Anchors and intermediate support members: Provide sizes capable of sustaining 5 times the load-carrying capabilities shown in ASTM C 635, Table 1, "Direct Hung" column.
2. Deck inserts and hanger clips: Fabricate from hot-dip galvanized steel.
3. Hanger wire: Zinc-coated (galvanized) carbon steel wire, ASTM A 641, soft temper, with Class 1 coating, minimum 12 gage (0.106 inch diameter).

E. Edge Moldings and Trim: Extruded aluminum or formed steel to match grid.
1. Provide profiles indicated.
2. Edge trim profile: Nominal 1- by 1-inch angle trim approved for use with seismic grid end clips.
3. Seismic Grid End Clips: Armstrong "BERC2" or approved equal.

2.4 LAY-IN ACoustical Ceilings

A. Acoustical Ceiling Tiles:
   2. Typical Size: 24 by 24 inches and 24 by 48 inches where shown

   B. Ceilings outside the basic work area that have been damaged by work on mechanical, electrical or other systems: Match existing as directed by Owner.

2.5 Suspension Systems

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
   1. Basis of Design Product: 15/16" "Prelude" by Armstrong.
   2. Beam End Retaining Clip: Armstrong "BERC2" or Approved Equal.
   3. Color: White

2.6 Lateral Force Bracing

A. Seismic Compression Struts: One of the following:
   1. 25 gauge metal studs.
      a. 1-5/8 inch: Up to 6'-2" length.
      b. 2-1/2 inch: Up to 10'-6" length.
   2. Thin wall conduit (EMT) per City of Seattle standards.
   3. Purpose-build telescoping strut such as USG "Telescoping Seismic Compression Post" or Chicago Metallic "Dina Strut."

   B. Splay Wires: Four 12-gage wires per seismic compression strut.

PART 3 - EXECUTION

3.1 Examination

A. Examine substrates and conditions under which products of this section are to be installed and verify that the work properly may commence.

B. Verify that products furnished as work of this section, but not installed under this section, have been properly installed by the entity performing the installation.
3.2 PREPARATION

A. Layout: Position ceiling components to maximize use of full-sized acoustical units and to provide border units which are equal in size and shape at opposing ceiling edges. Use of acoustical units that are smaller than 1/2 full-width is prohibited at ceiling perimeters. Conform to reflected ceiling plans to greatest extent possible.

3.3 SUSPENSION SYSTEM INSTALLATION

A. General:

1. Conform to the requirements of ASTM C 636, manufacturer's installation instructions, and governing regulations.
2. Install hangers plumb and supported solely by building structure or carrying channels. Do not allow hangers to contact any objects or materials in ceiling plenum that are not actual components of ceiling system.
   a. Splay hangers only where necessary to avoid obstacles. Provide countersplaying, bracing, or other acceptable devices to compensate for lateral stresses caused by splayed hangers.
   b. Install splay hangers or other means of seismic restraint as required to meet the requirements of ASTM E 580.
3. Space hangers at not more than 48 inches on center and within 6 inches of ends of each direct-hung runner or carrying channel, unless indicated otherwise.
4. Loop and tie wire hangers securely to building's structural members; to attachment devices indicated; or, where not indicated, to devices suitable for substrate and capable of permanently supporting ceiling weight without failure or deterioration.
5. Level ceiling suspension system to tolerance of 1/8 inch in 12 feet, with cumulative tolerance not to exceed 1/4 inch. Bending or kinking of hangers is not allowed.

B. Exposed (Lay-in) Grid Installation: Install grid members square, with ends of members securely interlocked. Remove and replace dented, bent, or kinked members.

C. Seismic Provisions: Provide lateral force bracing for all ceilings except ceilings less than 1000 square feet in area that are surrounded by four walls, each of which is braced to structure.

   1. Locate struts and splay wires at spacing not to exceed 12'-0" o.c. and not more than 6'-0" from each wall.
   2. Positively attach compression strut to suspension main beam and to structure above.
   3. Attach 4 splay wires to main beam at seismic compression strut. Array wires at 90 degrees to each other at an angle not exceeding 45 degrees from horizontal.

3.4 TRIM INSTALLATION

A. Install edge moldings and trim units at acoustical ceiling borders, at locations indicated, and where required to cover acoustical unit edges.

   1. Molding and trim attachment: Space screws not more than 16 inches on center and within 3 inches of ends of each trim-piece being installed. Install moldings and trim level with suspension system and within tolerance specified for suspension system.
2. Miter corners and align butt joints carefully to form tight hairline joints.

B. Seismic Provisions:
1. On opposite walls, install seismic grid end clips to attach grid to wall edge trim.

3.5 LAY-IN PANEL INSTALLATION

A. Panel Installation: Install acoustical panels for accurate fit with suspension system and trim members. Scribe and cut panels at ceiling perimeter and at obstructions to provide neat, precise fit.

1. Square-edge panel installation: Provide installation with panel edges that are hidden from view, by suspension members or trim.

3.6 ADJUST AND CLEAN

A. Use ceiling manufacturer's recommended methods and materials to clean and touch-up exposed components of ceiling system.

B. Replace ceiling system components that are discolored or damaged in any way, in a manner that results in the ceiling system showing no evidence of replacement 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:
      A. Solid vinyl floor tile.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Samples: Full-size units of each color, texture, and pattern of floor tile required.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 QUALITY ASSURANCE
   A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated with a minimum of 5 years of experience installing resilient tile flooring in an acute care environment.
   1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
   2. No sub-tier installation contractors are allowed.
1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile 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 (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive floor tile during the following periods:

B. Close spaces to traffic during floor tile installation.

C. Close spaces to traffic for 48 hours after floor tile installation.

D. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

   A. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL FLOOR TILE

A. Basis of Design Product: Floor tile manufactured by Mannington as specified on the drawings.

   1. Or approved Equal.

2.3 INSTALLATION MATERIALS

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

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile 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.
   
   A. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
   
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

   B. Concrete Substrates: Prepare according to ASTM F710.

   A. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   C. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by adhesive manufacturer in writing.
   D. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

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 floor tiles until materials are the same temperature as space where they are to be installed.

   A. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
   
   E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

   B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
A. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

A. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer’s written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

   A. Remove adhesive and other blemishes from surfaces.
   B. Sweep and vacuum surfaces thoroughly.
   C. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION 096519
PART 1 – GENERAL

1.1 SUMMARY

A. Surface preparation.

B. Application of paint materials to exposed interior items and surfaces indicated.

C. Field painting of the following is not required:
   1. Shop/factory painted mechanical and electrical equipment.
   2. Pre-finished items and materials.
   3. Concealed surfaces in generally inaccessible areas.
   4. Moving parts of operating units.
   5. Manufacturer and testing agency labels.
      a. Field paint all other items not listed above

1.2 SYSTEM DESCRIPTION

A. Surface preparation, prime and finish coats specified are in addition to shop-priming and surface treatments

B. Paint exposed surfaces whether or not colors are designated in "schedules," except where indicated that the surface or material is not to be painted or is to remain natural. Where item or surface is not mentioned, paint same as similar adjacent materials or surfaces. If color or finish is not designated, Architect will select from standard colors or finishes available.

C. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

D. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, or labels.
   1. Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels, or equipment name, identification, performance rating, or nomenclature plates.

1.3 SUBMITTALS

A. Provide mock-up on site to include doors walls and paneling. If approved, mock-up may be incorporated as finished work.

B. Product Data: Manufacturer’s printed technical specifications, label analysis, maintenance instructions, and application instructions for each paint product proposed for use.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.
D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current “MPI Approved Products List” for each product category specified in Part 2, with the proposed product highlighted.
3. VOC content.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and undercoat paint produced by same manufacturer as the finish coats.

B. Coordination of Work:

1. Review sections in which primers are provided to ensure compatibility of the total systems for various substrates.
2. Notify Owner of problems anticipated using materials specified.

C. Material Quality: Provide manufacturer’s best quality trade sale type paint material of various coating types specified. Paint material containers not displaying manufacturer’s product identification will not be acceptable:

1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with trade name and manufacturer's instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F (10 and 35 degrees C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

1.7 MAINTENANCE MATERIAL

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. (3.8 L) of each material and color applied.
PART 2 – PRODUCTS

2.1 MANUFACTURERS

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

1. Miller Paint Company. Ballard Location only.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Colors: As selected by Owner.

2.3 PRIMERS/SEALERS

A. Primer Sealer, Interior, Institutional Low Odor/VOC


B. Primer, Latex, for Interior Painted Wood

1. Basis of Design: Miller Acrylic Enamel Undercoat - 2840 – Water-based

C. Metal Primer, Water Based

1. Basis of Design: Acrimetal DTM – 5200

2.4 WATER-BASED PAINTS
A. Latex, Interior, Satin
   1. Basis of Design: Miller 1450 Satin Interior Paint

B. Latex, Metal, Satin
   1. Basis of Design: Miller Acrinamel Satin Paint

C. Latex, Interior Wood, Satin
   1. Basis of Design: Miller Acrinamel Satin Paint

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.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.
   5. Plaster: 12 percent.
      a. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
      b. Plaster Substrates: Verify that plaster is fully cured.
      c. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
      d. Proceed with coating application only after unsatisfactory conditions have been corrected.

C. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates 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 exceed that permitted in manufacturer's written instructions.

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

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

H. Aluminum Substrates: Remove loose surface oxidation.

I. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

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

B. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
   a. uninsulated metal piping.
   b. uninsulated plastic piping.
   c. pipe hangers and supports.
   d. metal conduit.
   e. plastic conduit.
   f. tanks that do not have factory-applied final finishes.
   g. duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. 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 owner.

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

3.4 FIELD QUALITY CONTROL
   A. Dry Film Thickness Testing: owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
      1. Contractor shall touch up and restore painted surfaces damaged by testing.
      2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer’s written recommendations, contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer’s written recommendations.

3.5 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. Provide “Wet Paint” signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Gypsum Drywall System, (Walls and Ceilings): Latex Satin Finish: Three coats, with total dry film thickness not less than 5.0 mils.
   1. Primer: Miller PVA Primer – 220-0-11 - Waterborne
   2. First and Second Finish Coats: Acrinamel Satin Interior Paint -1450 - Water Based

B. Gypsum Drywall System, (Walls and Ceilings where noted in Drawings): Latex Satin Finish: Three coats, with total dry film thickness not less than 5.0 mils.
   1. Primer: Miller PVA Primer – 220-0-11 - Waterborne
   2. First and Second Finish Coats: Acrinamel Satin Interior Paint - 7100 - Water Based

C. Ferrous Metal, Semi-Gloss Finish: Two finish coats over primer, with total dry film thickness not less than 5.0 mils.
   1. Primer: Acrimetal DTM - 5200 - Water Based. Primer is not required on items delivered shop-primed
   2. First and Second Finish Coats: Acrinamel Satin Paint 7100

D. Wood – Painted Satin Finish: Two finish coats over primer, with total dry film thickness not less than 5.0 mils.
   1. Primer: Miller Acrylic Enamel Undercoat - 2840 – Water-based
   2. First and Second Finish Coats: Acrinamel Satin Paint 7100

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Impact-resistant wall coverings.
   2. Corner guards.

1.2 SUBMITTALS
A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below
D. Impact-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.
E. Qualification Data: For qualified Installer.
F. Material Certificates: For each impact-resistant plastic material, from manufacturer.
G. Warranty: Sample of special warranty.
H. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.3 QUALITY ASSURANCE
A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
C. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
1.4 DELIVERY, STORAGE, AND HANDLING

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

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

B. Failures include, but are not limited to, the following:

1. Structural failures.
2. Deterioration of plastic and other materials beyond normal use.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Engineered PETG: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC-free plastic with integral color throughout; sheet material, thickness as indicated.

1. Impact Resistance: Tested according to ASTM D F476.
2. Chemical and Stain Resistance: Tested according to ASTM D 543
3. Fire performance characteristics: Tested according to ASTM E84, Class1.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.

C. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.
D. Stainless-Steel Sheet: ASTM A 240/A 240M.

E. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

F. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 IMPACT-RESISTANT WALL COVERINGS

A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
   1. Basis-of-Design Manufacturer: C/S Acrovyn
   2. IPC Plastic Sheet
   3. Wolfe Gordon; Rampart
   4. Or Approved Equal.

B. Products: As indicated in Drawings.

C. Height: As indicated in Drawings.

D. Mounting: Adhesive.

2.3 END WALL GUARDS

A. Surface-Mounted, Metal End Wall Guards: Fabricated as one-piece with formed edges; with 90- or 135-degree turn to match wall condition.

B. Material: Stainless Steel sheet.
   1. Thickness: Minimum 0.0781 inch (14 gauge)
   2. Finish: Directional satin, no. 4
   3. Wing size: 2-1/2” x 2-1/2” by full height of wall.
   4. Corner radius: 1/8”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   1. For impact-resistant wall protection units attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with defects that might be visible in the finished Work.

1. Impact-Resistant Wall Covering: Run full height of panel, horizontally, to eliminate or minimize seams. Where necessary, butt panels leaving 1/8” maximum joint. Install security sealant at vertical joints. Sealant color to match wall covering material.

3.4 CLEANING

A. Immediately after completion of installation, clean protection as recommended in writing by manufacturer.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Divisions 00 and 01, apply to this Section.

B. Related Sections include the following:
   1. Division 10.
   2. Division 21.
   3. Division 23.

1.2 SUMMARY

A. This section includes general and supplementary conditions specifically applicable to Division 21, in addition to Division 01.

B. This Section includes the following basic mechanical materials and methods to complement other Division 21 Sections.

   1. Submittals.
   2. Coordination Drawings.
   3. Record Documents.
   5. Piping materials and installation instructions common to most piping systems.
   6. Valves not required to be UL listed and FM approved
   7. Escutcheons.
   8. Dielectric fittings.
   10. Rough-ins.
   11. Fire suppression demolition.
   12. Fire suppression Installations.
   13. Cutting and patching.
   14. Touchup painting and finishing.

1.3 GENERAL REQUIREMENTS

A. Intent:

   1. The intent of the Contract Documents is for the Contractor to include all work necessary for the complete fire suppression systems, tested and ready for operation.
   2. By submitting a proposal, the Contractor represents that it has made a thorough examination of the site, of the work, and all existing conditions and limitations, and that it has examined the Contract Documents in complete detail and has determined beyond doubt that the drawings, specifications, and existing conditions are sufficient, adequate and satisfactory for the construction of the work under the Contract.
   3. Where minor adjustments of the work are necessary for purposes of fabrication or installation of items, or resolution of conflicts between items within the intent of the Contract Documents, the Contractor shall make such adjustments with no added
compensation. Where such adjustments affect functional or aesthetic design of the work, they shall first be submitted to the Owner for review and approval.

B. Conditions:

1. Conform to all Bidding Requirements, General Conditions and Amendments to the General Conditions, Supplementary Conditions and Special Conditions and General Requirements, Division 01, which govern the work specified herein.
2. The Contractor is obligated to comply with the above in addition to the requirements of this Section.
3. Modifications by this Section do not nullify any other portions of the above referenced conditions.

C. Make complete fire suppression installation, connecting to all equipment shown on the plans, or called for in the specifications.

D. Plans and Specifications: Plans and specifications shall be taken together.

1. Contractor shall provide all equipment, materials and work shown on the plans and/or called for in these specifications.
2. Provide work specified and not indicated on plans, or work indicated on plans and not specified, as though mentioned in both.
3. When discrepancies or conflicts occur within the documents, the Owner shall determine which takes precedence and the Contractor shall perform the selected requirement without additional cost.

E. Fire Suppression Drawings:

1. Verify exact distances between points shown of drawings by actual measurement at site, as no extra cost will be allowed for differences between actual measurements and scaled measurements.
2. Changes in design, configuration, or location of equipment, or piping, advisable in the opinion of Contractor, shall be submitted to Owner for approval before proceeding with work, with written assurance from other trades that such changes will not interfere with their installation, nor cause any extra cost on their part. Such changes shall be made at no additional cost to Owner.
3. Check location of all work of all trades and avoid interferences. Special attention is called to the following items; conflicts shall be reported to Owner for decision and direction:
   a. Exact location of outlets shown on architectural details.
   b. Location of suspended ceilings.
   c. Location of ducts, grilles, pipes, and other mechanical equipment so electrical outlets are clear of these items and in proper relation to same.

1.4 DEFINITIONS AND ABBREVIATIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, 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 spaces above hard or lay-in type ceilings and in duct shafts.

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. Domestic Water Piping: Piping inside building that conveys potable cold and hot water to fixtures and equipment throughout the building.

G. Non-Potable Water Piping: Piping inside building that conveys non-potable water to fixtures and equipment throughout the building.

H. The word "provide," as used in these specifications, means "furnish and install."

I. The word "approved," as used in these specifications, means acceptance by the Owner.

J. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the drawings, or other paragraphs or schedules in the specifications, and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the reader locate the reference. Location is not limited.

K. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted," mean directed by the Architect, requested by the Architect, and similar phrases.

L. Mechanical Systems - Including but not limited to:

2. Temperature Controls System.

M. Abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society of Testing Materials</td>
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<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
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<td>AWS</td>
<td>American Welding Society</td>
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<tr>
<td>FM</td>
<td>Factory Mutual Engineering Corporation</td>
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<tr>
<td>IBC</td>
<td>International Building Code</td>
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<tr>
<td>NEC</td>
<td>National Electric Code</td>
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<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
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<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>UPC</td>
<td>Uniform Plumbing Code</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratories</td>
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</tbody>
</table>
1.5 CODES, PERMITS AND INSPECTIONS

A. Codes: Work shall be installed as a minimum in conformity with applicable local ordinances and statutes. Standards and sizes, which exceed preceding requirements, shall be installed as drawn or specified. Nothing in the specifications shall be construed to permit deviation to less than the requirements of governing codes. Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of ordinances, laws, regulations, and codes.

B. Codes and Standards: Applicable codes and standards shall include, but not necessarily be limited to and shall be the current version adopted by the Authority Having Jurisdiction:

1. Uniform Plumbing Code, by International Association of Plumbing and Mechanical Officials.
3. Requirements of OSHA, EPA and WISHA.
5. All local and state amendments.
6. Requirements of all agencies have jurisdictional authority over installation of fire suppression systems.

C. Permits, Fees and Inspections:

1. Contractor shall arrange and pay for all permits, fees and inspections required in connection with this installation. The Contractor shall present the Owner with properly signed certificates of final inspection before the work will be accepted.
2. Contractor shall call for all inspections by local building official(s) when they become due and shall not cover any work until approved by these governing authorities.
3. Contractor shall make all arrangements with utility companies for water services associated with the work and include required payments for meters, piping, services, connection charges and materials furnished and installed by utility companies. Work and materials shall be in strict accordance with rules of respective authorities.

D. Underwriters Laboratory Approval: Where Underwriters Laboratories (UL) standards exist, all items of electrical equipment or items partially composed of electrical equipment shall carry Underwriters Laboratories (UL) label either for the entire unit or for the electrical portion of the equipment. If UL standards do not exist, equipment shall be provided that has been labeled by an independent testing agency that is recognized by the Authority Having Jurisdiction.

1.6 WORK INCLUDED

A. Work under this division shall include providing all materials, labor, equipment, tools, appliances, hoisting, scaffolding, supervision and overhead for the proper execution and completion of the fire suppression work.

B. Should these specifications or references made therein fail to specify adequately an item of equipment or material required for proper completion of the work in accordance with present day practice, this deficiency shall not relieve Contractor from furnishing and installing same. Call such omissions to attention of Owner and use such equipment or material as approved by Owner.

C. All new equipment and products as noted in Part 2 of each section shall be installed as per manufacturer's recommendations.
D. Provide all additional piping, and valves not shown on drawings, to maintain fully operational systems during the project at no additional cost to the Owner.

1.7 WORKMANKSHIP

A. This Contractor shall provide completed systems with a neat and finished appearance. If, in the judgment of the Owner, any portion of the work has not been performed in a workmanlike manner or is left in a rough, unfinished state, this Contractor will be required to remove, reinstall or replace same and patch and paint surrounding surfaces in a manner acceptable to the Owner, without increase in cost to the Owner.

1.8 SUBMITTALS, GENERAL REQUIREMENTS

A. General: Follow the procedures for submittals or as described herein and specified in Division 01.

B. General Requirements for Submittals: Provide the following submittals as indicated in each section. Additional submittal requirements may be included in the individual sections.

1. Product Data: Submit manufacturer’s product data for the items listed in the individual sections. Product data shall demonstrate compliance with all specified features and requirements. Submittals for equipment shall include, but not be limited to, data indicating equipment capacity meets the indicated values at specified conditions, equipment drawings indicating all dimensions, connection information, service space requirements, recommended piping and/or wiring diagrams, installation details and extended warranties either offered by equipment manufacturer or required by specifications.

2. Shop Drawings: Submit Contractor prepared drawings of Contractor fabricated mechanical systems. Drawings shall be prepared at ¼” scale using Computer Aided Design (CAD) software unless indicated otherwise. Drawings shall show exact location of equipment, and piping, each section of shop fabricated pipe and location of field joints, supports and building attachments, and seismic restraint locations.


4. Operation and Maintenance Data: Submit proposed Operation and Maintenance materials for approval prior to inclusion in the comprehensive final bound edition. See Article in this section on Operation and Maintenance Manuals for materials required to be included.

C. Format: Provide submittals arranged with numerical index and bookmarks in PDF electronic format containing the total volume of material. All product data shall be submitted complete by system, partial submittals are not acceptable and may be returned unreviewed. Systems are defined here as fire suppression system (Division 21). Reference submittals, including title and location of project, Architect, Contractor, submission date, and specification paragraph number to indicate clearly the location, service, equipment identification numbers as shown on drawings, and function of each particular item. Where manufacturers’ catalogs, pamphlets, or data sheets are submitted in lieu of prepared shop drawings, such submissions shall indicate specifically the item for which approval is required in red ink, and submissions showing general information only are not acceptable.

D. Submittals not in conformance to above paragraphs will be returned unreviewed.
1.9 SUBMITTALS, BASIC MECHANICAL MATERIALS

A. General: See Article in this section, Submittals, General Requirements for general requirements of Product Data, Shop Drawings, Reports and Certificates, and Operation and Maintenance data submittals.

B. Product Data: Provide submittals of the following:
   1. Gate Valves
   2. Ball Valves
   3. Braided Flexible Hose Connectors

C. Shop Drawings:

D. Reports and Certificates:

1.10 COORDINATION DRAWINGS

A. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
   1. Planned piping layout, including valve and specialty locations and valve-stem movement.
   2. Clearances for installing and maintaining insulation.
   3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
   4. Equipment and accessory service connections and support details.
   5. Other systems installed in same space as fire suppression systems.
   6. Fire-rated wall and floor penetrations.
   7. Ceiling and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
   8. Sizes and location of required concrete pads and bases.
   9. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
   10. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   11. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

1.11 SUBSTITUTIONS

A. Substitutions will only be considered after project award. No substitutions will be considered during bid and/or negotiation periods.

B. In all cases in this specification where an article is followed by the words "or equal," the Owner is the sole judge of the quality of the proposed substitution.

C. When the Owner approves a substitution, the approval is given with the understanding that the Contractor guarantees the article or material substituted to be equal to or better in every
respect than the article or material specified. The Contractor shall also assume complete responsibility that the article or material will fit the job as far as space, access and servicing requirements.

D. Where several materials are specified by name for one use, select for use any of those so specified subject to compliance with specified requirements.

E. Whenever item or class of material is specified exclusively by detail specification, trade name, manufacturer’s name or by catalog reference, use only such item, unless written approval is given. Submit written requests in accordance with Division 01 substitution requirements.

F. Make no substitutions for materials, articles or process required under contract unless written approval is obtained. See the Division 01 for project substitution requirements.

1.12 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 01. In addition to the requirements specified in Division 01, indicate the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located. Indicate actual inverts and horizontal locations of underground piping.
2. Record drawings shall incorporate all accepted change orders and RFIs; reference number on drawings is not acceptable.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
5. Contract Modifications, actual equipment and materials installed.
6. Record the locations and invert elevations of underground installations.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 01 and the following requirements. Manuals shall be hard cover, 3-post binder, and indexed by systems. Pages shall be same size, with exception of allowable foldout pages for control and flow diagrams. Cover shall be inscribed with name of project, Owner, description of contents, Architect, General Contractor, Mechanical Contractor, and date. In addition to the requirements specified in Division 01, include the following information in Division 21 materials:

1. Product Data of all equipment provided by the project as indicated in submittal requirements.
2. Manufacturer’s Equipment Installation and Start-Up Manuals for all equipment provided by the project. Manufacturer’s printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Manufacturer’s Equipment Service Manuals for all equipment provided by the project, including parts list, troubleshooting list and maintenance procedures for routine preventative maintenance. Include disassembly, repair, and reassembly; aligning and adjusting instructions; servicing instructions and lubrication charts and schedules.
4. Reports and Certificates of all systems and equipment as required by specifications.
5. Material Safety Data Sheets (MSDS) for all applicable materials used for all specified installations.

6. Warranty Certificates for all equipment where extended warranties are either offered or required; provide supplier contact information.

1.14 QUALITY ASSURANCE

A. Equipment Selection: Equipment allowed by the specifications but with different electrical characteristics, physical dimensions, capacities, and/or ratings than what is shown on the drawings may be furnished, provided such proposed equipment is approved in writing and connecting fire suppression and electrical services, such as pipe connection sizes, circuit breakers, conduit, motors, bases, and equipment spaces are revised to accommodate such equipment. All expenses shall be borne by the Contractor. Specified minimum energy ratings and/or equipment efficiencies must meet design and commissioning requirements.

1.15 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored mechanical equipment, pipes and tubes and other materials from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Pipes, equipment, and other materials that are damaged due to improper storage shall be replaced at the Contractor’s expense.

1.16 SEQUENCING AND SCHEDULING

A. Coordinate equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

D. Some equipment may require temporary installation during one phase and require relocation to final location under another phase. Provide all associated labor and materials to accommodate this phasing.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 08.
PART 2 – PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Refer to individual piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for fluid type, temperature and pressure of piping system.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless indicated otherwise.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

D. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

2.3 GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Gate Valves:
      a. Hammond Valve Corporation
      b. Milwaukee Valve Company, Inc.
      c. Nibco Inc.
      d. Or Approved Equal

B. Gate Valves: MSS SP-70, Class 125, ASTM A 126 cast-iron body and bonnet, solid cast-iron wedge, brass-alloy stem, outside screw and yoke, bolted body-bonnet connection, teflon-impregnated packing with 2-piece packing gland assembly, flanged end connections; and with cast-iron handwheel.

2.4 BALL VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ball Valves:
a. Conbraco Industries, Inc.; Apollo Division  
b. Hammond Valve Corporation  
c. Nibco Inc.  
d. Milwaukee Valve Company, Inc.  
e. Viega  
f. Or Approved Equal

B. Ball Valves, 2-Inches and Smaller: MSS SP-110, 600-psi CWP, Class 150, ASTM B 584 bronze body and end piece(s), 2-piece or 3-piece construction as required; stainless steel solid ball, full port, blowout proof; stainless steel stem; teflon seats and seals; threaded end connections as called for in Part 3. Vinyl-covered steel lever handle.

C. Hose End Drain Valves: MSS SP-110, 3/4-inch NPS, 400 psi CWP, Class 150, ASTM B 584 bronze body and end piece, two-piece construction, chrome plated ball, full port; brass stem; Teflon seats and seals; threaded end connections. Vinyl covered steel lever handle.

1. Outlet: Short threaded nipple with ASTM B1.20.7 garden-hose thread, cap, and drain.

2.5 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Dielectric Flanges:

      1) Capitol Manufacturing Co.  
      2) Central Plastics Co.  
      3) Epco Sales Inc.  
      5) Or Approved Equal

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Dielectric Couplings:
1) Calpico, Inc.
2) Lochinvar Corp.
3) Or Approved Equal

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dielectric Nipples:

1) Grinnell Corp.; Grinnell Supply Sales Co.
2) Victaulic Co. of America.
3) Or Approved Equal

2.6 FLEXIBLE CONNECTORS

A. Braided Hose Flexible Connectors: Stainless steel bellows with woven, flexible, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment. Bronze braiding for copper tubing applications and stainless steel braiding for steel pipe applications.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Braided Hose Flexible Connectors:

1) Flex-Hose Co, Inc.
2) Hyspan Precision Products, Inc.
3) Mason.
4) Mercer Rubber Co.
5) Metraflex Co.
6) Or Approved Equal

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated “wall pipe” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

a. Underdeck Clamp: Clamping ring with set screws.
B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.
   a. Finish: Rough brass.
   b. Finish: Polished chrome-plate.

2.8 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

2. Design Mix: 5000-psig, 28-day compressive strength.

PART 3 – EXECUTION

3.1 GENERAL FIRE SUPPRESSION INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of fire suppression systems, materials, and equipment. Comply with the following requirements:

1. Coordinate fire suppression systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for fire suppression installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of fire suppression materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of fire suppression systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Owner.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install fire suppression equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
11. Install access panel or doors where equipment is concealed behind finished surfaces. Notify General Contractor on the number, location and size of access panels or doors.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Install valves as indicated, according to manufacturer's written instructions.
14. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.
15. Locate valves for easy access and provide separate support where necessary.
16. Install valves in a position to allow full stem movement.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS
A. General: Install piping as described below, unless piping Sections specify otherwise. Individual piping Sections specify unique piping installation requirements.
B. General Locations and Arrangements: 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 at indicated slope.
D. Install components with pressure rating equal to or greater than system operating pressure.
E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
F. Install piping free of sags and bends.
G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
K. Install flexible connectors according to manufacturer's written instructions where indicated and specified in other piping sections.
L. Install fittings for changes in direction and branch connections.
M. Install couplings according to manufacturer's written instructions.
N. Do not route piping through elevator equipment rooms, unless specifically allowed by local authority.
O. Do not route piping over electrical panels, transformers, switchgear or other electrical equipment.
P. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

Q. Sleeves are not required for core drilled holes.

R. Permanent sleeves are not required for holes formed by PE removable sleeves.

S. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
   b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

T. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

W. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. 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:
   
a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. 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.

4. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench to recommended torque valves.

X. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install 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.

E. Install equipment giving right of way to piping installed at required slope.
3.4 VALVE APPLICATION SCHEDULE

A. General Application: Use gate, ball, and butterfly valves for shutoff duty; globe for throttling duty as indicated for valves not required to be UL listed and FM approved. Refer to piping system Specification Sections for specific valve applications and arrangements.

B. VALVE END SELECTION

1. Select valves with the following ends or types of pipe/tube connections:
   a. Steel Pipe Sizes, 2-Inches and Smaller: Threaded ends.
   b. Steel Pipe Sizes, 2-1/2-Inches and Larger: Flanged or grooved ends.

C. Fire Suppression Systems: Use the following valve types:

1. Gate Valves: Class 125, iron body.
2. Ball Valves: [2-piece][3-piece] with stem extension.

3.5 PAINTING AND FINISHING

A. Refer to Division 09.

B. Apply paint to exposed piping and supports according to the following, unless otherwise indicated:

1. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer. Paint not required on interior galvanized supports.
2. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor materials and equipment.


3.7 DEMOLITION

A. Perform all demolition or interface work required in the existing building for the removal of, or interface with, equipment, or piping. Relocate or modify the existing piping as required by any general construction alterations or by the installation of new piping in the existing building.

B. Existing Materials, Removal and Disposition:
1. **Scope:** For items that remain the property of the Owner, refer to drawings.

2. In coordination with the Owner's Representatives, these materials shall be made available for their inspection and decision as to whether the Owner will retain possession. Items selected for retention shall be delivered to a location on the premises selected by the Owner and turned over to them. Take reasonable care to avoid damage to this material.

3. All material not selected for retention by the Owner and debris shall be disposed of by the Contractor.

C. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

D. **Work Abandoned in Place:** Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. **Reuse of Materials:** Reuse of materials is prohibited unless specifically indicated or approved by Owner.

F. Notify Owner in discovery of any hazardous materials.

G. **Temporary Disconnection:** Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

### 3.8 CUTTING AND PATCHING

A. **General:** Perform cutting and patching in accordance with Division 01. In addition to the requirements specified in Division 01, the following requirements apply:

1. **Protection of Installed Work:** During cutting and patching operations, protect adjacent installations.

B. **Perform cutting, fitting, and patching of equipment and materials required to:**

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Owner, uncover and restore Work to provide for Owner observation of concealed Work.

C. Cut, remove and legally dispose off-site of selected equipment, components, and materials, including but not limited to removal of piping, heating units, plumbing fixtures and trim, and other items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. **Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for installations. Perform cutting by skilled mechanics of trades involved.**

F. Repair cut surfaces to match adjacent surfaces.
3.9 GROUTING

A. Install nonmetallic, nonshrink, grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete housekeeping pads to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

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. Pipes, fittings, and specialties.
      2. Specialty valves.
      3. Sprinkler specialty pipe fittings.
      4. Sprinklers.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product, include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   B. Shop Drawings: Include plans, elevations, sections, and attachment details.
   C. Delegated-Design Submittal: For wet-pipe 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.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For qualified Installer and professional engineer.
   B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authority having jurisdiction, including hydraulic calculations as applicable.
   C. 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.”
   D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.
B. As-Built drawings. Provide both:
   1. Hard copies with field changes marked up.
   2. Electronic CAD files with clouded field changes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.7 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.

1.8 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

   1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
   2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.
2.2 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13 Standard for the Installation of Sprinkler Systems
   2. Seattle Fire Department Administrative Rule 09.03

B. In the event of a discrepancy in the requirements listed above, the more stringent shall apply. Final system acceptance is subject to approval by the City of Seattle Fire Marshal.

C. Delegated Design: Engage a Nicet Level 3 or higher certified professional, as defined in Section 01 40 00 "Quality Requirements," to design automatic sprinkler systems.

D. Obtain water supply information from the University Fire Protection Engineer.

E. Sprinkler system design shall be approved by authorities having jurisdiction.
   1. Margin of Safety for Available Water Flow and Pressure: 10 psi, including losses through water-service piping, valves, and backflow preventers.
   2. Sprinkler Occupancy Hazard Classifications:
      a. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      b. General Storage Areas: Ordinary Hazard, Group 1.
      c. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      d. Offices and Public Areas: Light Hazard
   3. Minimum Density for Automatic-Sprinkler Piping Design:
      a. Light Hazard: 0.10 gpm over 1500 sq. ft. area.
      b. Ordinary Hazard, Group 1: 0.15 gpm over 1500 sq. ft. area.
      c. Ordinary Hazard, Group 2: 0.20 gpm over 1500 sq. ft. area.
   4. Maximum Protection Area per Sprinkler: According to UL listing.

F. Seismic Performance: Sprinkler piping shall be protected against damage from the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.3 STEEL PIPE AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.


D. Steel Couplings: ASTM A 865/A 865M, threaded.

E. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
F. Malleable- or Ductile-Iron Unions: UL 860.

G. Grooved-End, Steel-Pipe Appurtenances:
   1. Pressure Rating: 175-psig minimum.
   2. Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
   3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 SPRINKLER PIPING SPECIALTIES

A. Sprinkler specialty fittings shall be UL listed, with 175–psig minimum working-pressure rating, and made of materials compatible with piping.

B. Branch Outlet Fittings:
   4. Type: Mechanical-tee and -cross fittings.
   5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
   6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
   7. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Adjustable Drop Nipples:
   4. Size: Same as connected piping.
   5. Length: Adjustable.
   6. Inlet and Outlet: Threaded.

D. Flexible Sprinkler Hose Fittings:
   2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
   4. Size: Same as connected piping, for sprinkler.

2.5 SPRINKLERS

A. Listed in UL "Fire Protection Equipment Directory."

B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
C. Automatic Sprinklers with Heat-Responsive Element:
   1. Nonresidential Applications: UL 199.
   2. Characteristics: Quick-response (QR) type, nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes: Chrome plated.

E. Special Coatings: Corrosion-resistant paint.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
   2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G. Sprinkler Guards:
   2. Type: Wire cage with fastening device for attaching to sprinkler.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article. Report test results promptly and in writing.

B. Hydraulic water model may be used in lieu of flow test if acceptable to the AHJ.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
   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.
   2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
D. Install sprinkler piping with drains for complete system drainage.

E. Install hangers and supports for sprinkler system piping according to NFPA 13.

F. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.

G. Coordinate with Architect for installation of escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in threaded 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. Branch Outlet Fittings: Mechanical-tee and -cross fittings not permitted on new sprinkler piping. For connections to existing pipe, hang pipe cut-out (or coupon) from pipe or provide documentation of the procedure in place to ensure that all coupons have been retrieved.

G. 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.

H. 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.

I. Twist-Locked Joints: Not permitted.

J. Steel-Piping, Pressure-Sealed Joints: Not permitted.

K. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article. Field welding not permitted. All welded pipe joints shall be welded off-site.

L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
3.4 SPRINKLER INSTALLATION
   A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
   B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
   C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.5 IDENTIFICATION
   A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.6 FIELD QUALITY CONTROL
   A. Perform the following 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 and any additional requirements of the AHJ.
   B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
   C. Prepare test and inspection reports.

3.7 CLEANING
   A. Clean dirt and debris from sprinklers.
   B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.8 DEMONSTRATION
   A. Provide training for the Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.9 PIPING SCHEDULE
   A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
B. NPS 1-1/2 and smaller: Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints

C. NPS 2 and NPS 6: Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.10 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Semi-recessed sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
2. Upright and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

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. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
7. Control panels.
8. Pressure gages.

B. Related Section include the following:

1. Division 21 Section 21 13 13 “Wet-Pipe Sprinkler Systems”

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For dry-pipe 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.
1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and professional engineer.

B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

C. 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.”

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 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.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.

2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.
PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Single-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of fire-detection system, located in same area as sprinklers, opens deluge valve, permitting water to flow into sprinkler piping and to discharge from opened sprinklers.

2.2 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. Seattle Fire Code
   2. NFPA 13 Standard for the Installation of Sprinkler Systems
   3. Seattle Fire Department Administrative Rule 09.03 as applicable

B. In the event of a discrepancy in the requirements listed above, the more stringent shall apply. Final system acceptance is subject to approval by the City of Seattle Fire Marshal.

C. Delegated Design: Engage a Nicet Level 3 or higher certified professional, as defined in Section 01 40 00 "Quality Requirements," to design automatic sprinkler systems.

D. Sprinkler system design shall be approved by authorities having jurisdiction.
   1. Margin of Safety for Available Water Flow and Pressure: 10 psi, including losses through water-service piping, valves, and backflow preventers.
   2. Sprinkler Occupancy Hazard Classifications:
      a. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      b. General Storage Areas: Ordinary Hazard, Group 1.
      c. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      d. Offices and Public Areas: Light Hazard

3. Minimum Density for Automatic-Sprinkler Piping Design:
   1. Light Hazard: 0.10 gpm over 1500 sq. ft. area.
   2. Ordinary Hazard, Group 1: 0.15 gpm over 1500 sq. ft. area.
   3. Ordinary Hazard, Group 2: 0.20 gpm over 1500 sq. ft. area.

4. Maximum Protection Area per Sprinkler: According to UL listing.

E. Seismic Performance: Sprinkler piping shall be protected against damage from the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.3 STEEL PIPE AND FITTINGS

A. Schedule 40, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
B. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

C. Malleable- or Ductile-Iron Unions: UL 860.

D. Cast-Iron Flanges: ASME B16.1, Class 125.

E. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.

F. Grooved-Joint, Steel-Pipe Appurtenances:
   1. Pressure Rating: 175-psig minimum.
   2. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
   3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 SPECIALTY VALVES

A. Listed in UL "Fire Protection Equipment Directory."


C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Deluge Valves:
   1. Single-interlock preaction valve. Complete with releasing trim rated at 250 psi and all the necessary accessories. Trim shall include a mechanical latching device to prevent system from resetting in case of loss of power to the release solenoids. Systems provided with solenoids only, without this mechanical latching device, shall not be accepted. Every valve shall be clearly identified as to its operation with arrows indicating all positions to facilitate system operation.
   3. Design: Electrically operated, Differential-pressure type.
   4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
   5. Air Compressor:
      a. Existing

2.5 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.
B. Flow Detection and Test Assemblies:
   3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
   4. Size: Same as connected piping.
   5. Inlet and Outlet: Threaded.

C. Branch Line Testers:
   4. Size: Same as connected piping.
   5. Inlet: Threaded.
   6. Drain Outlet: Threaded and capped.
   7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:
   3. Body Material: Cast- or ductile-iron housing with sight glass.
   4. Size: Same as connected piping.
   5. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:
   4. Size: Same as connected piping.
   5. Length: Adjustable.
   6. Inlet and Outlet: Threaded.

2.6 SPRINKLERS

A. Listed in UL's "Fire Protection Equipment Directory."

B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:
   1. Nonresidential Applications: UL 199.
   2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes: Chrome plated.

E. Special Coatings: Corrosion-resistant paint.
F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

   1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
   2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G. Sprinkler Guards:

   2. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Pressure Switches:

   2. Type: Electrically supervised water-flow switch with retard feature.
   4. Design Operation: Rising pressure signals water flow.

C. Valve Supervisory Switches:

   2. Type: Electrically supervised.
   4. Design: Signals that controlled valve is in other than fully open position.
   5. 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

2.8 MANUAL CONTROL STATIONS

A. Listed in UL "Fire Protection Equipment Directory" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.9 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

   1. Listed in UL "Fire Protection Equipment Directory" when used with thermal detectors and Class A detector circuit wiring.
   2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
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.

B. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

C. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

D. Panels Components:
   1. Power supply.
   2. Battery charger.
   3. Standby batteries.
   5. Electrically supervised solenoid valves and polarized fire-alarm bell.
   7. Single-pole, double-throw auxiliary alarm contacts.
   8. Rectifier.

2.10 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch diameter.

C. Pressure Gage Range: 0- to 250-psig minimum.

D. Label: Include "WATER" or "AIR/WATER" label on dial face.

E. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article. Report test results promptly and in writing.

B. Hydraulic water model may be used in lieu of flow test if acceptable to the AHJ.

3.2 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping.
3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

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.

2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install "Inspector’s Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

F. Install sprinkler piping with drains for complete system drainage.

G. Connect compressed-air supply to dry-pipe sprinkler piping.

H. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

I. Install alarm devices in piping systems.

J. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

K. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they are not subject to freezing.

L. Drain dry-pipe sprinkler piping.

M. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices.

N. Install sleeves for piping penetrations of walls, ceilings, and floors.

O. Install escutcheons for piping penetrations of walls, ceilings, and floors.
3.4 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. Branch Outlet Fittings: Mechanical-tee and -cross fittings not permitted on new sprinkler piping. For connections to existing pipe, hang pipe cut-out (or coupon) from pipe or provide documentation of the procedure in place to ensure that all coupons have been retrieved.

G. 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.

H. 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.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection.

D. Specialty Valves:
   1. Install valves in vertical position for proper direction of flow, in main supply to system.
   2. Install single interlock pre-action system valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
a. Install air compressor and compressed-air-supply piping.
b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.

3.6 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 05 53 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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 air compressors.
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.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.
3.10 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Standard-pressure, dry-pipe sprinkler system, NPS 1-1/2 and smaller, shall be the following:
   1. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

C. Standard-pressure, dry-pipe sprinkler system, NPS 2 and NPS 6, shall be the following:
   1. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
   1. Rooms without Ceilings: Upright sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.
   1. Upright and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

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. Brass ball valves.
      2. Bronze ball valves.

1.3 DEFINITIONS
   A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of valve.
      1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Prepare valves for shipping as follows:
      1. Protect internal parts against rust and corrosion.
      2. Protect threads, flange faces, and soldered ends.
   B. Use the following precautions during storage:
      1. Maintain valve end protection.
      2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
   C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on steel valves.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valves in Insulated Piping:
   1. Include 2-inch stem extensions.
   2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
   3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, One-Piece:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. KITZ Corporation.
      b. WATTS.
   2. Description:
      b. CWP Rating: 400 psig.
      c. Body Design: One piece.
      d. Body Material: Forged brass or bronze.
e. Ends: Threaded and soldered.

f. Seats: PTFE.

g. Stem: Brass or stainless steel.

h. Ball: Chrome-plated brass or stainless steel.
i. Port: Reduced.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:

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

   a. American Valve, Inc.
   b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   c. Milwaukee Valve Company.
   d. Viega LLC.

2. Description:

   a. Standard: MSS SP-110 or MSS SP-145.
   b. CWP Rating: Minimum 200 psig.
   c. Body Design: Two piece.
   d. Body Material: Forged brass.
   e. Ends: Press.
   g. Seats: PTFE or RPTFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.
   j. Port: Full.
   k. O-Ring Seal: Buna-N or EPDM.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:

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

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Center Line; Crane Energy Flow Solutions.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Viega LLC.

2. Description:

   a. Standard: MSS SP-110 or MSS-145.
   b. CWP Rating: Minimum 200 psig.
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Press.
g. Seats: PTFE or RTPF.
h. Stem: Bronze or brass.
i. Ball: Chrome-plated brass.
j. Port: Full.
k. O-Ring Seal: EPDM or Buna-N.

B. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Center Line; a Crane Co. brand.
   c. DynaQuip Controls.
   d. Hammond Valve.
   e. Jenkins Valves; a Crane Co. brand.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corp.
   i. Stockham; a Crane Co. brand.
   j. Viega LLC.
   k. WATTS.

2. Description:
   a. Standard: MSS SP-110 or MSS-145.
   b. CWP Rating: 600 psig.
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded or soldered.
   f. Seats: PTFE.
   g. Stem: Stainless steel.
   h. Ball: Stainless steel, vented.
   i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
2. Iron ball valves, Class 150.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Brass ball valve, one piece. Provide with threaded or solder-joint ends.
2. Bronze ball valve, one piece with bronze trim. Provide with threaded or solder-joint ends.
3. Brass ball valves, two-piece with regular port and brass trim. Provide with threaded solder joint ends.
4. Bronze ball valves, two-piece with regular port and bronze or brass trim. Provide with threaded solder joint ends.

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. Copper tube and fittings.
      2. Dielectric fittings.

1.3 ACTION SUBMITTALS
   A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS
   A. System purging and disinfecting activities report.
   B. Field quality-control reports.

1.5 FIELD CONDITIONS
   A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
      1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
      2. Do not interrupt water service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS
   A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.


C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

D. Copper Unions:
   1. MSS SP-123.
   4. Solder-joint or threaded ends.

E. Copper, Brass, or Bronze Pressure-Seal-Joint Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. Elkhart Products Corporation.
      c. Mueller Industries, Inc.
      d. NIBCO INC.
      e. Viega LLC.

   2. Fittings: Cast-brass, cast-bronze or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 and larger with stainless steel grip ring and EPDM O-ring seal.

   3. Minimum 200-psig working-pressure rating at 250 deg F.

F. Copper Push-on-Joint Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. NIBCO INC.

   2. Description:
      a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
      b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.
2.3 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Dresser, Inc.
      c. Ford Meter Box Company, Inc. (The).
      d. Jay R. Smith Mfg Co; a division of Morris Group International.
      e. JCM Industries, Inc.
      f. Romac Industries, Inc.
      g. Smith-Blair, Inc.
      h. Viking Johnson.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A.Y. McDonald Mfg. Co.
      b. Capitol Manufacturing Company.
      c. Central Plastics Company.
      d. HART Industrial Unions, LLC.
      e. Jomar Valve.
      f. Matco-Norca.
      g. WATTS.
      h. Wilkins.
      i. Zurn Industries, LLC.
   3. Pressure Rating: 125 psig minimum at 180 deg F.
PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install shutoff valve immediately upstream of each dielectric fitting.
B. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
C. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
G. Install piping to permit valve servicing.
H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
I. Install piping free of sags and bends.
J. Install fittings for changes in direction and branch connections.
K. Install sleeve seals for piping penetrations of concrete walls and slabs.
L. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
C. 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.
D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Install hangers for copper, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
   2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Piping Inspections:
a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. 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:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. 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.
c. 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.
d. 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 it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.6 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. Repeat procedures if biological examination shows contamination.
   e. Submit water samples in sterile bottles to authorities having jurisdiction.

3.7 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed soldered joints.
   2. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.
3.8 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION
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. Copper tube and fittings.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.4 FIELD CONDITIONS
   A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
      1. Notify Construction Manager Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
      2. Do not proceed with interruption of sanitary waste service without Construction Manager's written permission.

1.5 WARRANTY
   A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Copper Pressure Fittings:
   2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
   1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. 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 soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

J. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

L. Install sleeves for piping penetrations of walls, ceilings, and floors.
   1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install sleeve seals for piping penetrations of concrete walls and slabs.
   1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install escutcheons for piping penetrations of walls, ceilings, and floors.
   1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers for copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:
   1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3.5 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
      a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
      a. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
   a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
   b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
   c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
   a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
   b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
   c. Air pressure must remain constant without introducing additional air throughout period of inspection.
   d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
      a. Expose work that was covered or concealed before it was tested.
   2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
      a. Isolate test source and allow to stand for four hours.
      b. Leaks and loss in test pressure constitute defects that must be repaired.
   3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   4. Prepare reports for tests and required corrective action.

3.6 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping 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.
D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.7 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
1. Copper Type DWV tube, copper drainage fittings, and soldered joints.

B. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
1. Copper Type DWV tube, copper drainage fittings, and soldered joints.
  
a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

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. Handwash sinks.
   2. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
   2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.5 HANDWASH SINKS

A. Handwash Sinks Insert drawing designation: Stainless steel, under counter mounted.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Tabco.
      b. Elkay.
      c. Just Manufacturing.
      d. Sloan Valve Company.
   2. Fixture: see drawings
1.6 SINK FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, two lever handle mixing valve.
   1. Commercial, Solid-Brass Faucets
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Chicago Faucets; Geberit Company.
         2) Elkay.
         3) Kohler Co.
   3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
   5. Spout Outlet: Aerator.

1.7 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:
   1. NPS 1/2.
   2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

1.8 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

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

2.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according toICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping"

2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks.

2.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

2.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

2.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

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. Brass ball valves.
   2. Bronze ball valves.

1.3 DEFINITIONS
A. CWP: Cold working pressure.
B. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and weld ends.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded-end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on steel valves.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   6. ASME B31.1 for power piping valves.
   7. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Refer to HVAC valve schedule articles for applications of valves.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
   1. Handlever: For quarter-turn valves smaller than NPS 2.

H. Valves in Insulated Piping:
   1. Include 2-inch stem extensions.
   2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
   3. Memory stops that are fully adjustable after insulation is applied.

I. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, One-Piece:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. KITZ Corporation.
2. Description:
   b. CWP Rating: 400 psig.
   c. Body Design: One piece.
   d. Body Material: Forged brass.
   e. Ends: Threaded.
   f. Seats: PTFE.
   g. Stem: Brass.
   h. Ball: Chrome-plated brass.
   i. Port: Reduced.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded Ends:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      c. DynaQuip Controls.
      d. Hammond Valve.
      e. Jomar Valve.
      f. KITZ Corporation.

   2. Description:
      b. SWP Rating: 150 psig.
      c. CWP Rating: 600 psig.
      d. Body Design: Two piece.
      e. Body Material: Forged brass.
      f. Ends: Threaded.
      g. Seats: PTFE.
      h. Stem: Brass.
      i. Ball: Chrome-plated brass.
      j. Port: Full.

C. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Threaded Ends:

   1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:
      a. Crane; a Crane brand.
      b. Flow-Tek, Inc.
      c. Hammond Valve.
      d. Jamesbury; Metso.
      e. Jenkins Valves; a Crane Co. brand.
      f. KITZ Corporation.

   2. Description:
      b. SWP Rating: 150 psig.
2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port and Bronze or Brass Trim, Threaded Ends:

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

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Crane; a Crane brand.
   c. Hammond Valve.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Red-White Valve Corp.
   g. WATTS.

2. Description:

   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE.
   h. Stem: Bronze.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

B. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

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

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Crane; a Crane brand.
   c. Hammond Valve.
   d. Milwaukee Valve Company.
2. Description:

b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.
3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 CHILLED-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Brass or bronze ball valves, two piece, with brass trim, full port, threaded-joint ends.

1. Valves may be provided with solder-joint ends instead of threaded ends.

3.5 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Brass or bronze ball valves, two piece with brass bronze trim, full port, threaded-joint ends.

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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.

B. Related Requirements:
1. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
2. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL-HANGER SHIELD INSERTS

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

1. Buckaroos, Inc.
2. Carpenter & Paterson, Inc.
4. Pipe Shields Inc.
5. Piping Technology & Products, Inc.
B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

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.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hilti, Inc.
   b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
   c. MKT Fastening, LLC.
   d. Simpson Strong-Tie Co., Inc.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eaton (B-line).
   b. Empire Tool and Manufacturing Co., Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
   e. MKT Fastening, LLC.

2. Indoor Applications: Zinc-coated or stainless-steel.

2.6 MATERIALS

A. Aluminum: ASTM B221.
B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, 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.

PART 3 - EXECUTION

3.1 APPLICATION
   A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

   B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION
   A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

   B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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 for individual pipe hangers.
      2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

   C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

   D. Fastener System Installation:

      1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use
operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer’s operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer’s written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. 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.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:

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 allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 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/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. 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.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
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. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restraint cables.
5. Mechanical anchor bolts.
6. Adhesive anchor bolts.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.
2. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by OSHPD and acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces required to select vibration isolators and seismic restraints and for designing vibration isolation bases.
   a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
   b. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   c. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   d. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
   e. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Welding certificates.

C. Field quality-control reports.
1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads: .

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

   a. Ace Mountings Co., Inc.
   b. California Dynamics Corporation.
   c. Isolation Technology, Inc.
   d. Kinetics Noise Control, Inc.
   e. Korfund.
   f. Mason Industries, Inc.
   g. Novia; A Division of C&P.
   h. nVent (CADDY).
   i. Vibration Eliminator Co., Inc.
   j. Vibration Isolation.
   k. Vibration Management Corp.
   l. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.

3. Size: Factory or field cut to match requirements of supported equipment.

4. Pad Material: Oil and water resistant with elastomeric properties.

5. Surface Pattern: Smooth pattern.

6. Infused nonwoven cotton or synthetic fibers.

7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.
   a. Surface Pattern: Smooth pattern.
   b. Infused nonwoven cotton or synthetic fibers.

2.2 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ace Mountings Co., Inc.
   b. California Dynamics Corporation.
   c. Kinetics Noise Control, Inc.
   d. Mason Industries, Inc.
   e. Novia; A Division of C&P.
   f. nVent (CADDY).
   g. Vibration Eliminator Co., Inc.
   h. Vibration Isolation.
   i. Vibration Management Corp.
   j. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.3 RESTRAINT CABLES

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

1. nVent (CADDY).
2. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

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

1. Eaton (B-line).
2. Mason Industries, Inc.
3. nVent (CADDY).

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

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

1. Atkore International (Unistrut).
2. Eaton (B-line).
3. Hilti, Inc.
4. Mason Industries, Inc.
5. Powers Fasteners.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.6 ADHESIVE ANCHOR BOLTS

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

1. Atkore International (Unistrut).
2. Eaton (B-line).
3. Hilti, Inc.
4. Mason Industries, Inc.
5. Powers Fasteners.

B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for OSHPD an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES an agency acceptable to authorities having jurisdiction that provides required submittals for component.

H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate
with connection to equipment that is anchored to a different structural element from the one
supporting the connections as they approach equipment. Comply with requirements in
Section 232113 "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable
to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to
restrained component (unless postconnection testing has been approved), and with at
least seven days’ advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary
load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by
Architect.
5. Test to 90 percent of rated proof load of device.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height.
After equipment installation is complete, adjust limit stops so they are out of contact during
normal operation.

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. Equipment labels.
   2. Pipe labels.
   3. Duct labels.
   4. Valve tags.
   5. Warning tags.

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS
A. Metal Labels for Equipment:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Brimar Industries, Inc.
      c. Carlton Industries, LP.
      d. Champion America.
2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.


4. Background Color: Black.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 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-quarters 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. Plastic Labels for Equipment:

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

   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Carlton Industries, LP.
   d. Champion America.
   e. Craftmark Pipe Markers.
   f. emedco.
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc.
   j. Seton Identification Products; a Brady Corporation company.

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


4. Background Color: Blue Red White Yellow Insert color.

5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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

7. 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-quarters the size of principal lettering.


9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

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

2.2 PIPE LABELS

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

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
4. Carlton Industries, LP.
5. Champion America.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services Inc.
11. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include 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: Size letters according to ASME A13.1 for piping.

2.3 VALVE TAGS

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

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
4. Carlton Industries, LP.
5. Champion America.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services Inc.
11. Seton Identification Products; a Brady Corporation company.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire-link chain or beaded chain or S-hook.

C. 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.

2.4 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Brimar Industries, Inc.
   3. Champion America.
   5. emedco.
   7. LEM Products Inc.
   8. Marking Services Inc.
   9. Seton Identification Products; a Brady Corporation company.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 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. 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.

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. Pipe Label Locations: 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 and on both sides of 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.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:


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 HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

2. Valve-Tag Colors:
   a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.
   b. Flammable Fluids: Black letters on a safety-yellow background.
   d. Potable and Other Water: White letters on a safety-green background.
   e. Compressed Air: White letters on a safety-blue background.
   f. Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

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. Balancing Air Systems:
         a. Constant-volume air systems.
         b. Multizone systems.
      2. Balancing Hydronic Piping Systems:
         a. Constant-flow hydronic systems.
      3. Balancing steam systems.
      4. Testing, Adjusting, and Balancing Equipment:
         a. Motors.
         b. Heat-transfer coils.
      5. Testing, adjusting, and balancing existing systems and equipment.
      6. Control system verification.

1.3 DEFINITIONS
   B. BAS: Building automation systems.
   D. TAB: Testing, adjusting, and balancing.
   F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
   G. TDH: Total dynamic head.
1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days’ advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:
   b. The TAB plan.
   c. Needs for coordination and cooperation of trades and subcontractors.
   d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.


D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
B. TAB Specialists Qualifications: Certified by NEBB or TABB.
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
   2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:
   1. Neudorfer Engineers.
   2. ABB certified balancing company
   3. Approved equal.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.
D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:
   a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
   b. Duct systems are complete with terminals installed.
   c. Volume, smoke, and fire dampers are open and functional.
   d. Clean filters are installed.
   e. Fans are operating, free of vibration, and rotating in correct direction.
   f. Variable-frequency controllers' startup is complete and safeties are verified.
   g. Automatic temperature-control systems are operational.
   h. Ceilings are installed.
   i. Windows and doors are installed.
   j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:
   a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
   b. Piping is complete with terminals installed.
   c. Water treatment is complete.
   d. Systems are flushed, filled, and air purged.
   e. Strainers are pulled and cleaned.
   f. Control valves are functioning per the sequence of operation.
   g. Shutoff and balance valves have been verified to be 100 percent open.
   h. Pumps are started and proper rotation is verified.
   i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
   j. Variable-frequency controllers' startup is complete and safeties are verified.
   k. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses, close to the fan and prior to any outlets, to obtain total airflow.

c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.

b. Measure static pressure directly at the fan inlet or through the flexible connection.

c. Measure static pressure across each component that makes up the air-handling system.

d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Owner Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.
3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
   1. Check highest vent for adequate pressure.
   2. Check flow-control valves for proper position.
   3. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
   4. Verify that motor starters are equipped with properly sized thermal protection.
   5. Check that air has been purged from the system.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. For systems with pressure-independent valves at terminals:
   1. Measure differential pressure and verify that it is within manufacturer's specified range.
   2. Perform temperature tests after flows have been verified.

B. For systems without pressure-independent valves or flow-measuring devices at terminals:
   1. Measure and balance coils by either coil pressure drop or temperature method.
   2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

C. Verify final system conditions as follows:
   1. Re-measure and confirm that total water flow is within design.
   2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
   3. Mark final settings.

D. Verify that memory stops have been set.

3.9 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   4. Phase and hertz.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter size and thermal-protection-element rating.
   8. Service factor and frame size.
B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.10 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:
   1. Entering- and leaving-water temperature.
   2. Water flow rate.
   3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
   4. Dry-bulb temperature of entering and leaving air.
   5. Wet-bulb temperature of entering and leaving air for cooling coils.
   6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:
   1. Nameplate data.
   2. Airflow.
   3. Entering- and leaving-air temperature at full load.
   4. Voltage and amperage input of each phase at full load.
   5. Calculated kilowatt at full load.
   6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:
   1. Dry-bulb temperature of entering and leaving air.
   2. Airflow.
   3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:
   1. Dry-bulb temperature of entering and leaving air.
   2. Wet-bulb temperature of entering and leaving air.
   3. Airflow.

3.11 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.12 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:
   1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.
3.14 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   2. Air Outlets and Inlets: Plus or minus 10 percent.
   3. Heating-Water Flow Rate: Plus or minus 10 percent.
   4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.15 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.16 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.
   3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers' test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB specialist.
   3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
   a. Indicated versus final performance.
   b. Notable characteristics of systems.
   c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
   a. Settings for outdoor-, return-, and exhaust-air dampers.
   b. Conditions of filters.
   c. Cooling coil, wet- and dry-bulb conditions.
   d. Face and bypass damper settings at coils.
   e. Fan drive settings including settings and percentage of maximum pitch diameter.
   f. Inlet vane settings for variable-air-volume systems.
   g. Settings for supply-air, static-pressure controller.
   h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
   h. Sheave make, size in inches, and bore.
   i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
   f. Preheat-coil static-pressure differential in inches wg.
   g. Cooling-coil static-pressure differential in inches wg.
   h. Heating-coil static-pressure differential in inches wg.
   i. Outdoor airflow in cfm.
   j. Return airflow in cfm.
   k. Outdoor-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.
   f. Make and model number.
   g. Face area in sq. ft..
   h. Tube size in NPS.
   i. Tube and fin materials.
   j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Average face velocity in fpm.
   c. Air pressure drop in inches wg.
   d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
   e. Return-air, wet- and dry-bulb temperatures in deg F.
   f. Entering-air, wet- and dry-bulb temperatures in deg F.
   g. Leaving-air, wet- and dry-bulb temperatures in deg F.
   h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.

j. Entering-water temperature in deg F.

k. Leaving-water temperature in deg F.

l. Refrigerant expansion valve and refrigerant types.

m. Refrigerant suction pressure in psig.

n. Refrigerant suction temperature in deg F.

o. Inlet steam pressure in psig.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.

4. Unit Data:
   a. System and air-handling unit identification.
   b. Location and zone.
   c. Apparatus used for test.
   d. Area served.
   e. Make.
   f. Number from system diagram.
   g. Type and model number.
   h. Size.
   i. Effective area in sq. ft..

5. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

H. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:
   a. System and air-handling-unit identification.
   b. Location and zone.
   c. Room or riser served.
   d. Coil make and size.
   e. Flowmeter type.

2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Entering-water temperature in deg F.
   c. Leaving-water temperature in deg F.
   d. Water pressure drop in feet of head or psig.
   e. Entering-air temperature in deg F.
   f. Leaving-air temperature in deg F.

I. Instrument Calibration Reports:

1. Report Data:
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.17 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

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 insulating the following duct services:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

B. Related Sections:
   1. Section 230716 "HVAC Equipment Insulation."
   2. Section 230719 "HVAC Piping Insulation."
   3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
   3. Detail application of field-applied jackets.
   4. Detail application at linkages of control devices.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing 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 agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS


B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA.
   b. Armacell LLC.
   c. K-Flex USA.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed Corporation.
   b. CertainTeed Insulation.
   c. Johns Manville; a Berkshire Hathaway company.
   d. Knauf Insulation.
   e. Manson Insulation Inc.
   f. Owens Corning.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA.
   b. Armacell LLC.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. K-Flex USA.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.
2.3 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Knauf Insulation.
   d. Vimasco Corporation.

2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.


2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Vimasco Corporation.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.

3. Service Temperature Range: 0 to plus 180 deg F.


2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.

5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Avery Dennison Corporation, Specialty Tapes Division.
   b. Compac Corporation.
   c. Ideal Tape Co., Inc., an American Biltrite Company.
   d. Knauf Insulation.
   e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Avery Dennison Corporation, Specialty Tapes Division.
   b. Compac Corporation.
   c. Ideal Tape Co., Inc., an American Biltrite Company.
   d. Knauf Insulation.
   e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 SECUREMENTS

A. Bands:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ITW Insulation Systems; Illinois Tool Works, Inc.
   b. RPR Products, Inc.

2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, wide with wing seal or closed seal.

3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, wide with wing seal or closed seal.


B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) AGM Industries, Inc.
      2) Gemco.
      3) Hardcast; a Carlisle Company.
      4) Midwest Fasteners, Inc.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) AGM Industries, Inc.
      2) CL WARD & Family Inc.
      3) Gemco.
      4) Hardcast; a Carlisle Company.
      5) Midwest Fasteners, Inc.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) AGM Industries, Inc.
      2) Gemco.
      3) Midwest Fasteners, Inc.
b. **Baseplate:** Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. **Spindle:** Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

d. **Adhesive:** Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. **Insulation-Retaining Washers:** Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

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

1) AGM Industries, Inc.
2) Gemco.
3) Hardcast; a Carlisle Company.
4) Midwest Fasteners, Inc.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. **Staples:** Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

**PART 3 - EXECUTION**

3.1 **EXAMINATION**

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 **PREPARATION**

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 **GENERAL INSTALLATION REQUIREMENTS**

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

E. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."
3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer’s recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Impale insulation over pins and attach speed washers.
   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

   d. Do not overcompress insulation during installation.

   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
5. Flexible connectors.
7. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

C. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.
D. Concealed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

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 insulation for HVAC piping systems.

B. Related Sections:

1. Section 230713 "Duct Insulation" for duct insulation.
2. Section 230716 "HVAC Equipment Insulation" for equipment insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

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.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing 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 agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS


B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials, Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA.
   b. Airex Manufacturing.
   c. Armacell LLC.
   d. K-Flex USA.


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Johns Manville; a Berkshire Hathaway company.
   b. Knauf Insulation.
   c. Manson Insulation Inc.
   d. Owens Corning.

   2. Preformed Pipe Insulation: Type I, Grade A, without factory-applied jacket.
   3. 850 deg F.
   4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
   5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed Corporation.
   b. Johns Manville; a Berkshire Hathaway company.
   c. Knauf Insulation.
   d. Manson Insulation Inc.
   e. Owens Corning.

   2. Semirigid board material with factory-applied ASJ jacket.
   3. Nominal density is 2.5 lb/cu. ft. or more.
   4. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less.
   5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Mon-Eco Industries, Inc.
   d. Vimasco Corporation.

C. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Foster Brand; H. B. Fuller Construction Products.

2.3 MASTICS AND COATINGS

A. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
      c. Mon-Eco Industries, Inc.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to 180 deg F.

2.4 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
      c. Mon-Eco Industries, Inc.
      d. Pittsburgh Corning Corporation.

   2. Permanently flexible, elastomeric sealant.
      a. Service Temperature Range: Minus 100 to plus 300 deg F.
      b. Color: White or gray.
2.5 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ITW Insulation Systems; Illinois Tool Works, Inc.
   b. RPR Products, Inc.

2. Stainless Steel: ASTM A240/A240M, (Type 304) [or] (Type 316); 0.015 inch thick, [1/2 inch] [3/4 inch] wide with (wing seal) [or] (closed seal).

3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, [1/2 inch] [3/4 inch] wide with (wing seal) [or] (closed seal).

4. Springs: Twin spring set constructed of stainless steel, with ends flat and slotted to accept metal bands. Spring size is determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4 inch wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer’s recommended coverage rate and wet and dry film thicknesses.

L. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

O. For above-ambient services, do not install insulation to the following:
   1. Testing agency labels and stamps.
   2. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

C. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement.
Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word “union” matching size and color of pipe labels.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer’s written instructions.

2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.
3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Underground piping.
   2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Chilled Water and Brine, 40 Deg F and below:
   1. NPS 3 and Smaller: Insulation shall be one of the following:
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

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. DDC system for monitoring and controlling of HVAC systems.

B. Related Requirements:
   1. Section 230993.11 "Sequence of Operations for HVAC DDC" for control sequences in DDC systems.
   2. Communications Cabling:
      b. Section 271513 "Communications Copper Horizontal Cabling" for balanced twisted pair communications cable.

3. Raceways:
   a. Section 260533 "Raceways and Boxes for Electrical Systems" for raceways for low-voltage control cable.
   b. Section 270528 "Pathways for Communications Systems" for raceways for balanced twisted pair cabling and optical fiber cable.

4. Section 260553 "Identification for Electrical Systems" for identification requirements for electrical components.

1.3 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. BACnet Specific Definitions:
2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.

3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.


5. PICS (Protocol Implementation Conformance Statement): Written document that identifies the particular options specified by BACnet that are implemented in a device.

D. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.

F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.

G. COV: Changes of value.

H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.

I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems shall be capable of operating in a standalone mode using the last best available data.

J. DOCSIS: Data-Over Cable Service Interface Specifications.

K. E/P: Voltage to pneumatic.

L. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

M. HLC: Heavy load conditions.

N. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

O. I/P: Current to pneumatic.

P. LAN: Local area network.
Q. LNS: LonWorks Network Services.

R. LON Specific Definitions:

1. FTT-10: Echelon Transmitter-Free Topology Transceiver.
2. LonMark: Association comprising suppliers and installers of LonTalk products. Association provides guidelines for implementing LonTalk protocol to ensure interoperability through a standard or consistent implementation.
3. LonTalk: An open standard protocol developed by the Echelon Corporation that uses a "Neuron Chip" for communication. LonTalk is a register trademark of Echelon.
4. LonWorks: Network technology developed by Echelon.
5. Node: Device that communicates using CEA-709.1-C protocol and that is connected to a CEA-709.1-C network.
6. Node Address: The logical address of a node on the network, consisting of a Domain number, Subnet number, and Node number. "Node number" portion of an address is a number assigned to device during installation, is unique within a subnet, and is not a factory-set unique Node ID.
7. Node ID: A unique 48-bit identifier assigned at factory to each CEA-709.1-C device. Sometimes called a "Neuron ID."
8. Program ID: An identifier (number) stored in a device (usually EEPROM) that identifies node manufacturer, functionality of device (application and sequence), transceiver used, and intended device usage.
10. Standard Network Variable Type (SNVT): Pronounced "snivet." A standard format type maintained by LonMark used to define data information transmitted and received by individual nodes. "SNVT" is used in two ways. It is an acronym for "Standard Network Variable Type" and is often used to indicate a network variable itself (i.e., it can mean "a network variable of a standard network variable type").
11. Subnet: Consists of a logical grouping of up to 127 nodes, where logical grouping is defined by node addressing. Each subnet is assigned a number, which is unique within a Domain. See "Node Address."
12. TP/FT-10: Free Topology Twisted Pair network defined by CEA-709.3 and is most common media type for a CEA-709.1-C control network.
13. TP/XF-1250: High-speed, 1.25-Mbps, twisted-pair, doubly terminated bus network defined by "LonMark Interoperability Guidelines" typically used only to connect multiple TP/FT-10 networks.
14. User-Defined Configuration Property Type (UCPT): Pronounced "U-Keep-It." A Configuration Property format type that is defined by device manufacturer.
15. User-Defined Network Variable Type (UNVT): Network variable format defined by device manufacturer. UNVTs create non-standard communications that other vendors' devices may not correctly interpret and may negatively impact system operation. UNVTs are not allowed.

S. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

T. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

V. MS/TP: Master-slave/token-passing, IEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

W. MTBF: Mean time between failures.

X. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

Y. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

Z. Peer to Peer: Networking architecture that treats all network stations as equal partners.

AA. POT: Portable operator's terminal.

BB. PUE: Performance usage effectiveness.

CC. RAM: Random access memory.

DD. RF: Radio frequency.

EE. Router: Device connecting two or more networks at network layer.

FF. Server: Computer used to maintain system configuration, historical and programming database.

GG. TCP/IP: Transport control protocol/Internet protocol.

HH. UPS: Uninterruptible power supply.

II. USB: Universal Serial Bus.

JJ. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

KK. VAV: Variable air volume.

LL. WLED: White light emitting diode.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Multiple Submissions:

1. If multiple submissions are required to execute work within schedule, first submit a coordinated schedule clearly defining intent of multiple submissions. Include a proposed
date of each submission with a detailed description of submittal content to be included in each submission.

2. Clearly identify each submittal requirement indicated and in which submission the information will be provided.

3. Include an updated schedule in each subsequent submission with changes highlighted to easily track the changes made to previous submitted schedule.

B. Product Data: For each type of product include the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.


4. Installation, operation and maintenance instructions including factors effecting performance.

5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
   a. DDC controllers.
   b. Enclosures.
   c. Accessories.
   d. Instruments.
   e. Control dampers and actuators.
   f. Control valves and actuators.

6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.

7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.

C. Shop Drawings:

1. General Requirements:
   a. Include cover drawing with Project name, location, Owner, Architect, Contractor and issue date with each Shop Drawings submission.
   b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.

2. Include plans, elevations, sections, and mounting details where applicable.

3. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

4. Detail means of vibration isolation and show attachments to rotating equipment.

5. Plan Drawings indicating the following:
   a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork and piping.
b. Room names and numbers with coordinated placement to avoid interference with control products indicated.

c. Each desktop workstation, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.

d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.

e. Network communication cable and raceway routing.

f. Information, drawn to scale.

g. Proposed routing of wiring, cabling, conduit, and tubing, coordinated with building services for review before installation.

6. Schematic drawings for each controlled HVAC system indicating the following:

a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.

b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.

c. A graphic showing location of control I/O in proper relationship to HVAC system.

d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.

e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.

f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.

g. Narrative sequence of operation.

h. Graphic sequence of operation, showing all inputs and output logical blocks.

7. Control panel drawings indicating the following:

a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.

b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates and allocated spare space.

c. Front, rear, and side elevations and nameplate legend.

d. Unique drawing for each panel.

8. DDC system network riser diagram indicating the following:

a. Each device connected to network with unique identification for each.

b. Interconnection of each different network in DDC system.

c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.

d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.

9. DDC system electrical power riser diagram indicating the following:

a. Each point of connection to field power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
b. Each control power supply including, as applicable, transformers, power-line
conditioners, transient voltage suppression and high filter noise units, DC power
supplies, and UPS units with unique identification for each.
c. Each product requiring power with requirements (volts/phase/hertz/ampere/connection type) listed for each.
d. Power wiring type and size, race type, and size for each.

10. Monitoring and control signal diagrams indicating the following:
   a. Control signal cable and wiring between controllers and I/O.
   b. Point-to-point schematic wiring diagrams for each product.
   c. Control signal tubing to sensors, switches and transmitters.
   d. Process signal tubing to sensors, switches and transmitters.

11. Color graphics indicating the following:
   a. Itemized list of color graphic displays to be provided.
   b. For each display screen to be provided, a true color copy showing layout of
      pictures, graphics and data displayed.
   c. Intended operator access between related hierarchical display screens.

D. Delegated-Design Submittal: For DDC system products and installation indicated as being
   delegated.
1. Supporting documentation showing DDC system design complies with performance
   requirements indicated, including calculations and other documentation necessary to
   prove compliance.
2. Schedule and design calculations for control dampers and actuators.
   a. Flow at Project design and minimum flow conditions.
   b. Face velocity at Project design and minimum airflow conditions.
   c. Pressure drop across damper at Project design and minimum airflow conditions.
   d. AMCA 500-D damper installation arrangement used to calculate and schedule
      pressure drop, as applicable to installation.
   e. Maximum close-off pressure.
   f. Leakage airflow at maximum system pressure differential (fan close-off pressure).
   g. Torque required at worst case condition for sizing actuator.
   h. Actuator selection indicating torque provided.
   i. Actuator signal to control damper (on, close or modulate).
   j. Actuator position on loss of power.
   k. Actuator position on loss of control signal.
3. Schedule and design calculations for control valves and actuators.
   a. Flow at Project design and minimum flow conditions.
   b. Pressure-differential drop across valve at Project design flow condition.
   c. Maximum system pressure-differential drop (pump close-off pressure) across valve
      at Project minimum flow condition.
   d. Design and minimum control valve coefficient with corresponding valve position.
   e. Maximum close-off pressure.
   f. Leakage flow at maximum system pressure differential.
   g. Torque required at worst case condition for sizing actuator.
   h. Actuator selection indicating torque provided.
i. Actuator signal to control damper (on, close or modulate).

j. Actuator position on loss of power.

k. Actuator position on loss of control signal.

4. Schedule and design calculations for selecting flow instruments.

   a. Instrument flow range.
   b. Project design and minimum flow conditions with corresponding accuracy, control signal to transmitter and output signal for remote control.
   c. Extreme points of extended flow range with corresponding accuracy, control signal to transmitter and output signal for remote control.
   d. Pressure-differential loss across instrument at Project design flow conditions.
   e. Where flow sensors are mated with pressure transmitters, provide information for each instrument separately and as an operating pair.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   a. Product installation location shown in relationship to room, duct, pipe and equipment.
   b. Structural members to which products will be attached.
   c. Wall-mounted instruments located in finished space showing relationship to light switches, fire-alarm devices and other installed devices.
   d. Size and location of wall access panels for products installed behind walls and requiring access.

2. Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   a. Ceiling components.
   b. Size and location of access panels for products installed above inaccessible ceiling assemblies and requiring access.
   c. Items penetrating finished ceiling including the following:

          1) Lighting fixtures.
          2) Air outlets and inlets.
          3) Speakers.
          4) Sprinklers.
          5) Access panels.
          6) Motion sensors.
          7) Pressure sensors.
          8) Temperature sensors and other DDC control system instruments.

B. Qualification Data:

1. Systems Provider Qualification Data:
a. Resume of project manager assigned to Project.
b. Resumes of application engineering staff assigned to Project.
c. Resumes of installation and programming technicians assigned to Project.
d. Resumes of service technicians assigned to Project.
e. Brief description of past project including physical address, floor area, number of floors, building system cooling and heating capacity and building's primary function.
f. Description of past project DDC system, noting similarities to Project scope and complexity indicated.
g. Names of staff assigned to past project that will also be assigned to execute work of this Project.
h. Owner contact information for past project including name, phone number, and e-mail address.
i. Contractor contact information for past project including name, phone number, and e-mail address.
j. Engineer contact information for past project including name, phone number, and e-mail address.

2. Manufacturer's qualification data.
3. Testing agency's qualifications data.

C. Product Certificates:
   1. Data Communications Protocol Certificates: Certifying that each proposed DDC system component complies with ASHRAE 135.

D. Product Test Reports: For each product that requires testing to be performed by manufacturer.

E. Preconstruction Test Reports: For each separate test performed.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranty: For manufacturer's warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For DDC system to include in emergency, operation and maintenance manuals.

   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      
a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
c. As-built versions of submittal Product Data.
d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.

f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.

g. Engineering, installation, and maintenance manuals that explain how to:

1) Design and install new points, panels, and other hardware.
2) Perform preventive maintenance and calibration.
3) Debug hardware problems.
4) Repair or replace hardware.

h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.

i. Backup copy of graphic files, programs, and database on electronic media such as DVDs.

j. List of recommended spare parts with part numbers and suppliers.

k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.

l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.

m. Licenses, guarantees, and warranty documents.

n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

o. Owner training materials.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials and parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Include product manufacturers’ recommended parts lists for proper product operation over four-year period following warranty period. Parts list shall be indicated for each year.

C. Furnish parts, as indicated by manufacturer's recommended parts list, for product operation during one-year period following warranty period.

D. Furnish quantity indicated of matching product(s) in Project inventory for each unique size and type of following:
   1. Room Temperature Sensor: One.
   2. General-Purpose Relay: One.

1.9 QUALITY ASSURANCE

A. DDC System Manufacturer Qualifications:
1. Nationally recognized manufacturer of DDC systems and products.
2. DDC systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. DDC systems and products that have been successfully tested and in use on at least three past projects.
4. Having complete published catalog literature, installation, operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:
   a. Product research and development.
   b. Product and application engineering.
   c. Product manufacturing, testing and quality control.
   d. Technical support for DDC system installation training, commissioning and troubleshooting of installations.
   e. Owner operator training.

B. DDC System Provider Qualifications:

1. Authorized representative of, and trained by, DDC system manufacturer.
2. In-place facility located within 50 miles of Project.
3. Demonstrated past experience with installation of DDC system products being installed for period within three consecutive years before time of bid.
4. Demonstrated past experience on five projects of similar complexity, scope and value.
5. Each person assigned to Project shall have demonstrated past experience.
6. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
7. Service and maintenance staff assigned to support Project during warranty period.
8. Product parts inventory to support on-going DDC system operation for a period of not less than 5 years after Substantial Completion.
9. DDC system manufacturer’s backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer’s corporate officer, if requested.

C. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency’s Field Supervisor: Certified by NETA to supervise on-site testing.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
   a. Install updates only after receiving Owner's written authorization.
3. Warranty service shall occur during normal business hours and commence within 16 hours of Owner's warranty service request.
4. Warranty Period: Two year(s) from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 DDC SYSTEM MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alerton Inc.
2. Automated Logic Corporation.
3. Johnson Controls, Inc.
4. Siemens Industry, Inc. (Building Technologies Division).

2.2 DDC SYSTEM DESCRIPTION

A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.

1. DDC system shall consist of a high-speed, peer-to-peer network of distributed DDC controllers, other network devices, operator interfaces, and software.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 “Quality Requirements,” to design DDC system to satisfy requirements indicated.

B. Delegated Design: Engage a qualified professional to design DDC system to satisfy requirements indicated.

1. System Performance Objectives:

   a. DDC system shall manage HVAC systems.
   b. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
   c. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
   d. DDC system shall operate while unattended by an operator and through operator interaction.
   e. DDC system shall record trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.

C. Surface-Burning Characteristics: Products installed in ducts, equipment, and return-air paths shall comply with ASTM E84; 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: 50 or less.

D. DDC System Speed:

1. Response Time of Connected I/O:
   
a. AI point values connected to DDC system shall be updated at least every five seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
   
b. BI point values connected to DDC system shall be updated at least every five seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
   
c. AO points connected to DDC system shall begin to respond to controller output commands within two second(s). Global commands shall also comply with this requirement.
   
d. BO point values connected to DDC system shall respond to controller output commands within two second(s). Global commands shall also comply with this requirement.

2. Display of Connected I/O:
   
a. Analog point COV connected to DDC system shall be updated and displayed at least every 10 seconds for use by operator.
   
b. Binary point COV connected to DDC system shall be updated and displayed at least every 10 seconds for use by operator.
   
c. Alarms of analog and digital points connected to DDC system shall be displayed within 45 seconds of activation or change of state.
   
d. Graphic display refresh shall update within eight seconds.
   
e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations shall not exceed graphic refresh rate indicated.

E. DDC System Data Storage:

1. Include capability to archive not less than 36 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends and other information indicated.

F. DDC Data Access:

1. When logged into the system, operator shall be able to also interact with any DDC controller connected to DDC system as required for functional operation of DDC system.

2. System(s) shall be used for application configuration; for archiving, reporting and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.

G. Input Point Displayed Accuracy: Input point displayed values shall meet following end-to-end overall system accuracy, including errors associated with meter, sensor, transmitter, lead wire or cable, and analog to digital conversion.

1. Temperature, Dry Bulb:
a. Air: Within 1 deg F.
b. Space: Within 1 deg F.
c. Outdoor: Within 2 deg F.
d. Chilled Water: Within 1 deg F.
e. Heating Hot Water: Within 1 deg F.
f. Other Temperatures Not Indicated: Within 1 deg F.

H. Precision of I/O Reported Values: Values reported in database and displayed shall have following precision:

1. Current:
   a. Milliamperes: Nearest 1/100th of a milliampere.
   b. Amperes: Nearest 1/10th of an ampere up to 100 A; nearest ampere for 100 A and more.

2. Position, Dampers and Valves (Percentage Open): Nearest 1 percent.

3. Pressure:
   a. Air, Ducts and Equipment: Nearest 1/10th in. w.c..
   b. Water: Nearest 1/10 psig through 100 psig; nearest psig above 100 psig.

4. Temperature:
   a. Air, Ducts and Equipment: Nearest 1/10th of a degree.
   b. Outdoor: Nearest degree.
   c. Space: Nearest 1/10th of a degree.
   d. Chilled Water: Nearest 1/10th of a degree.
   e. Heating Hot Water: Nearest degree.

5. Voltage: Nearest 1/10 volt up to 100 V; nearest volt above 100 V.

6. Temperature, Dry Bulb:
   a. Air: Within 2 deg F.
   b. Space: Within 2 deg F.
   c. Chilled Water: Within 1 deg F.
   d. Heating Hot Water: Within 2 deg F.

I. Environmental Conditions for Controllers, Gateways, and Routers:

1. Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location.
   a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application.

2. Products shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Products not available with integral enclosures complying with requirements indicated shall be housed in
protective secondary enclosures. Installed location shall dictate the following NEMA 250 enclosure requirements:
   a. Indoors, Heated with Filtered Ventilation: Type 1.
   b. Indoors, Heated and Air Conditioned: Type 1.

3. Instruments and actuators shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
   a. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated and ventilated as required by instrument and application.

4. Instruments, actuators and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments and actuators not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Installed location shall dictate the following NEMA 250 enclosure requirements:
   a. Indoors, Heated with Filtered Ventilation: Type 1.
   b. Indoors, Heated and Air-conditioned: Type 1.

2.4 DDC CONTROLLERS

A. DDC system shall consist of a combination of network controllers, programmable application controllers and application-specific controllers to satisfy performance requirements indicated.

B. DDC controllers shall perform monitoring, control, energy optimization and other requirements indicated.

C. DDC controllers shall use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.

D. Each DDC controller shall be capable of full and complete operation as a completely independent unit and as a part of a DDC system wide distributed network.

E. Environment Requirements:
   1. Controller hardware shall be suitable for the anticipated ambient conditions.
   2. Controllers located in conditioned space shall be rated for operation at 32 to 120 deg F.

F. DDC Controller Spare Processing Capacity:
   1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:
      a. Application-Specific Controllers: Not less than 70 percent.
2. Memory shall support DDC controller’s operating system and database and shall include the following:
   a. Monitoring and control.
   b. Energy management, operation and optimization applications.
   c. Alarm management.
   d. Historical trend data of all connected I/O points.
   e. Maintenance applications.
   f. Operator interfaces.
   g. Monitoring of manual overrides.

G. DDC Controller Spare I/O Point Capacity: Include spare I/O point capacity for each controller as follows:

1. Programmable Application Controllers:
   a. 10 percent of each AI, AO, BI, and BO point connected to controller.
   b. Minimum Spare I/O Points per Controller:
      
      1) AIs: Two.
      2) AOs: Two.
      3) BIs: Three.
      4) BOs: Three.

2. Application-Specific Controllers:
   a. 10 percent of each AI, AO, BI, and BO point connected to controller.
   b. Minimum Spare I/O Points per Controller:
      
      1) AIs: One.
      2) AOs: One.
      3) BIs: One.
      4) BOs: One.

H. Maintenance and Support: Include the following features to facilitate maintenance and support:

1. Mount microprocessor components on circuit cards for ease of removal and replacement.
2. Means to quickly and easily disconnect controller from network.
3. Means to quickly and easily access connect to field test equipment.
4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.

2.5 PROGRAMMABLE APPLICATION CONTROLLERS

A. General Programmable Application Controller Requirements:

1. Include adequate number of controllers to achieve performance indicated.
2. Controller shall have enough memory to support its operating system, database, and programming requirements.
3. Data shall be shared between networked controllers and other network devices.
4. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Controllers that perform scheduling shall have a real-time clock.
6. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
7. Controllers shall be fully programmable.

B. Communication:
1. Programmable application controllers shall communicate with other devices on network.

C. Operator Interface:
1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation or mobile device.
2. Local Keypad and Display:
   a. Equip controller with local keypad and digital display for interrogating and editing data.
   b. Use of keypad and display shall require security password.

D. Serviceability:
1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall maintain BIOS and programming information in event of a power loss for at least 72 hours.

2.6 APPLICATION-SPECIFIC CONTROLLERS

A. Description: Microprocessor-based controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. Controllers are not fully user-programmable but are configurable and customizable for operation of equipment they are designed to control.
1. Capable of standalone operation and shall continue to include control functions without being connected to network.
2. Data shall be shared between networked controllers and other network devices.

B. Communication: Application-specific controllers shall communicate with other application-specific controller and devices on network, and to programmable application and network controllers.

C. Operator Interface: Controller shall be equipped with a service communications port for connection to a portable operator's workstation. Connection shall extend to port on space temperature sensor that is connected to controller.

D. Serviceability:
1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Controller shall use nonvolatile memory and maintain all BIOS and programming information in event of power loss.

2.7 CONTROLLER SOFTWARE

A. General Controller Software Requirements:

1. Software applications shall reside and operate in controllers. Editing of applications shall occur at operator workstations.
2. I/O points shall be identified by up to 30-character point name and up to 16-character point descriptor. Same names shall be used at operator workstations.
3. Control functions shall be executed within controllers using DDC algorithms.
4. Controllers shall be configured to use stored default values to ensure fail-safe operation. Default values shall be used when there is a failure of a connected input instrument or loss of communication of a global point value.

B. Security:

1. Operator access shall be secured using individual security passwords and user names.
2. Passwords shall restrict operator to points, applications, and system functions as assigned by system manager.
3. Operator log-on and log-off attempts shall be recorded.
4. System shall protect itself from unauthorized use by automatically logging off after last keystroke. The delay time shall be operator-definable.

C. Scheduling: Include capability to schedule each point or group of points in system. Each schedule shall consist of the following:

1. Weekly Schedule:
   a. Include separate schedules for each day of week.
   b. Each schedule should include the capability for start, stop, optimal start, optimal stop, and night economizer.
   c. Each schedule may consist of up to 10 events.
   d. When a group of objects are scheduled together, include capability to adjust start and stop times for each member.

2. Exception Schedules:
   a. Include ability for operator to designate any day of the year as an exception schedule.
   b. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by regular schedule for that day of week.

3. Holiday Schedules:
a. Include capability for operator to define up to 99 special or holiday schedules.
b. Schedules may be placed on scheduling calendar and will be repeated each year.
c. Operator shall be able to define length of each holiday period.

D. System Coordination:
1. Include standard application for proper coordination of equipment.
2. Application shall include operator with a method of grouping together equipment based on function and location.
3. Group may then be used for scheduling and other applications.

E. Binary Alarms:
1. Each binary point shall be set to alarm based on operator-specified state.
2. Include capability to automatically and manually disable alarming.

F. Analog Alarms:
1. Each analog object shall have both high and low alarm limits.
2. Alarming shall be able to be automatically and manually disabled.

G. Alarm Reporting:
1. Operator shall be able to determine action to be taken in event of an alarm.
2. Alarms shall be routed to appropriate operator workstations based on time and other conditions.
3. Alarm shall be able to start programs, print, be logged in event log, generate custom messages, and display graphics.

2.8 ENCLOSURES

A. General Enclosure Requirements:
1. House each controller and associated control accessories in a single enclosure. Enclosure shall serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies and transformers.
2. Do not house more than one controller in a single enclosure.
3. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.
4. Equip doors of enclosures housing controllers and components with analog or digital displays with windows to allow visual observation of displays without opening enclosure door.
5. Individual wall-mounted single-door enclosures shall not exceed 36 inches wide and 48 inches high.

B. Combination On-Off Status Sensor and On-Off Relay:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Functional Devices Inc.
2. Description:
   a. On-off control and status indication in a single device.
   b. LED status indication of activated relay and current trigger.
   c. Closed-Open-Auto override switch located on the load side of the relay.

3. Performance:
   a. Ambient Temperature: Minus 30 to 140 deg F.

4. Status Indication:
   a. Current Sensor: Integral sensing for single-phase loads up to 20 A and external solid or split sensing ring for three-phase loads up to 150 A.
   b. Current Sensor Range: As required by application.
   c. Current Set Point: Fixed or adjustable as required by application.
   d. Current Sensor Output:
      1) Solid-state, single-pole double-throw contact rated for 30-V ac and dc and for 0.4 A.
      2) Solid-state, single-pole double-throw contact rated for 120-V ac and 1.0 A.
      3) Analog, zero- to 5- or 10-V dc.
      4) Analog, 4 to 20 mA, loop powered.

6. Enclosure: NEMA 250, Type 1 enclosure.

2.9 CONTROL WIRE AND CABLE

A. Single Twisted Shielded Instrumentation Cable above 24 V:
   1. Wire size shall be a minimum No. 18 AWG.
   2. Conductors shall be a twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
   3. Conductor insulation shall have a Type THHN/THWN or Type TFN rating.
   4. Shielding shall be 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
   5. Outer jacket insulation shall have a 600-V, 90-deg C rating and shall be Type TC cable.
   6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
   7. Furnish wire on spools.

B. Single Twisted Shielded Instrumentation Cable 24 V and Less:
   1. Wire size shall be a minimum No. 18 AWG.
   2. Conductors shall be a twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
   3. Conductor insulation shall have a nominal 15-mil thickness, constructed from flame-retardant PVC.
4. Shielding shall be 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
5. Outer jacket insulation shall have a 300-V, 105-deg C rating and shall be Type PLTC cable.
6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
7. Furnish wire on spools.

2.10 ACCESSORIES

A. Damper Blade Limit Switches:
   1. Sense positive open and/or closed position of the damper blades.
   2. NEMA 250, Type 13, oil-tight construction.
   3. Arrange for the mounting application.
   4. Additional waterproof enclosure when required by its environment.
   5. Arrange to prevent "over-center" operation.

B. Manual Valves:
   1. Ball Type:
      a. Manufacturers: Subject to compliance with requirements, provide products by the following:
         1) NIBCO INC.
      c. Ball: Type 316 stainless steel.
      d. Stem: Type 316 stainless steel.
      e. Seats: Reinforced PTFE.
      f. Packing Ring: Reinforced PTFE.
      g. Lever: Stainless steel with a vinyl grip.
      h. 600 WOG.
      i. Threaded end connections.

2.11 IDENTIFICATION

A. Control Equipment, Instruments, and Control Devices:
      a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.
   2. Letter size shall be as follows:
      a. Accessories: Minimum of 0.25 inch Insert dimension high.
      b. Instruments: Minimum of 0.25 inch Insert dimension high.
      c. Control Damper and Valve Actuators: Minimum of 0.25 inch Insert dimension high.
3. Legend shall consist of white lettering on black background.
4. Laminated acrylic or melamine plastic sign shall be engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers are color-coded black with contrasting white center exposed by engraving through outer layer and shall be fastened with drive pins.
5. Instruments, control devices and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

B. Valve Tags:
1. Brass tags and brass chains attached to valve.
2. Tags shall be at least 1.5 inches in diameter.
3. Include tag with unique valve identification indicating control influence such as flow, level, pressure, or temperature; followed by location of valve, and followed by three-digit sequential number. For example: TV-1.001.
4. Valves with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require an additional tag.

C. Equipment Warning Labels:
1. Self-adhesive label with pressure-sensitive adhesive back and peel-off protective jacket.
2. Lettering size shall be at least 14-point type with white lettering on red background.
3. Warning label shall read "CAUTION-Equipment operated under remote automatic control and may start or stop at any time without warning. Switch electric power disconnecting means to OFF position before servicing."
4. Lettering shall be enclosed in a white line border. Edge of label shall extend at least 0.25 inch beyond white border.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify compatibility with and suitability of substrates.

B. Examine roughing-in for products to verify actual locations of connections before installation.
1. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
2. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DDC SYSTEM INTERFACE WITH OTHER SYSTEMS AND EQUIPMENT

A. Communication Interface to Equipment with Integral Controls:

1. DDC system shall have communication interface with equipment having integral controls and having a communication interface for remote monitoring or control.
2. Equipment to Be Connected:
   a. Fan-coil units specified in Section 238219 "Fan Coil Units."

3.3 DDC SYSTEM INTERFACE WITH EXISTING SYSTEMS

A. Interface with Existing Systems:

1. DDC systems shall interface existing systems to achieve integration.
2. Monitoring and Control of DDC System by Existing Control System:
   a. DDC system performance requirements shall be satisfied when monitoring and controlling DDC system by existing control system.
   b. Operator of existing system shall be able to upload, download, monitor, trend, control and program every input and output point in DDC system from existing control system using existing control system software and operator workstations.
   c. Remote monitoring and control from existing control system shall not require operators of existing control system to learn new software.
   d. Interface of DDC system into existing control system shall be transparent to operators of existing control system and allow operators to program, monitor, and control monitor and control DDC system from any operator workstation connected to existing control system.

B. Integration with Existing Enterprise System:

1. DDC system shall interface with an existing enterprise system to adhere to Owner standards already in-place and to achieve integration.
2. Owner's control system integrator will provide the following services:
   a. Enterprise system expansion and development of graphics, logs, reports, trends and other operational capabilities of enterprise system for I/O being added to DDC control system for use by enterprise system operators.
   b. Limited assistance during commissioning to extent of DDC system integration with existing enterprise system.
   c. Prepare on-site demonstration mockup of integration of DDC system to be installed with existing system before installing DDC system.

3. Engage Owner's control system integrator to provide the following services:
   a. Enterprise system expansion and development of graphics, logs, reports, trends and other operational capabilities of enterprise system for I/O being added to DDC control system for use by enterprise system operators.
b. Limited assistance during commissioning to extent of DDC system integration with existing enterprise system.
c. Prepare on-site demonstration mockup of integration of DDC system to be installed with existing system before installing DDC system.

4. Attend meetings with control system integrator to integrate DDC system.

3.4 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.

B. Deliver the following to duct fabricator and Installer for installation in ductwork. Include installation instructions to Installer and supervise installation for compliance with requirements.
   1. DDC control dampers, which are specified in Section 230923.12 "DDC Control Dampers."

C. Deliver the following to plumbing and HVAC piping installers for installation in piping. Include installation instructions to Installer and supervise installation for compliance with requirements.
   1. DDC control valves, which are specified in Section 230923.11 "Control Valves."
   2. Pipe-mounted flow meters, which are specified in Section 230923.14 "Flow Instruments."
   3. Pipe-mounted sensors, switches and transmitters. Flow meters are specified in Section 230923.14 "Flow Instruments." Liquid temperature sensors, switches, and transmitters are specified in Section 230923.27 "Temperature Instruments."
   4. Pipe- and tank-mounted thermowells. Liquid thermowells are specified in Section 230923.27 "Temperature Instruments."

3.5 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

D. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

E. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."

F. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

G. Fastening Hardware:
1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.

H. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.6 ENCLOSURES INSTALLATION

A. Install the following items in enclosures, to comply with indicated requirements:
   1. Controllers.

B. Attach wall-mounted enclosures to wall using the following types of steel struts:
   1. For NEMA 250, Type 1 Enclosures: Use painted steel strut and hardware.

3.7 CONTROL WIRE, CABLE AND RACEWAYS INSTALLATION

A. Comply with NECA 1.

B. Wire and Cable Installation:
   1. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.
      a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.
   2. Terminate wiring in a junction box.
      a. Clamp cable over jacket in junction box.
      b. Individual conductors in the stripped section of the cable shall be slack between the clamping point and terminal block.
   3. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
   4. Install signal transmission components according to IEEE C2, REA Form 511a, NFPA 70, and as indicated.
   5. Use shielded cable to transmitters.
   6. Use shielded cable to temperature sensors.
   7. Perform continuity and meager testing on wire and cable after installation.
3.8 DDC SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material and support.

E. For pneumatic products, verify that air supply for each product is properly installed.

F. Control Damper Checkout:
   1. Verify that control dampers are installed correctly for flow direction.
   2. Verify that proper blade alignment, either parallel or opposed, has been provided.
   3. Verify that damper frame attachment is properly secured and sealed.
   4. Verify that damper actuator and linkage attachment is secure.
   5. Verify that actuator wiring is complete, enclosed and connected to correct power source.
   6. Verify that damper blade travel is unobstructed.

G. Control Valve Checkout:
   1. Verify that control valves are installed correctly for flow direction.
   2. Verify that valve body attachment is properly secured and sealed.
   3. Verify that valve actuator and linkage attachment is secure.
   4. Verify that actuator wiring is complete, enclosed and connected to correct power source.
   5. Verify that valve ball, disc or plug travel is unobstructed.
   6. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

H. Instrument Checkout:
   1. Verify that instrument is correctly installed for location, orientation, direction and operating clearances.
   2. Verify that attachment is properly secured and sealed.
   3. Verify that conduit connections are properly secured and sealed.
   4. Verify that wiring is properly labeled with unique identification, correct type and size and is securely attached to proper terminals.
   5. Inspect instrument tag against approved submittal.
   6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
   7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
   8. For temperature instruments:
      a. Verify sensing element type and proper material.
      b. Verify length and insertion.
3.9 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION AND TESTING:

A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

C. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.

D. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.

E. Provide diagnostic and test equipment for calibration and adjustment.

F. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. An installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

G. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.

H. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.

I. Comply with field testing requirements and procedures indicated by ASHRAE’s Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

J. Analog Signals:
   1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
   2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
   3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

K. Digital Signals:
   1. Check digital signals using a jumper wire.
   2. Check digital signals using an ohmmeter to test for contact making or breaking.

L. Control Dampers:
   1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
   2. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed and 100 percent open at proper air pressure.
   3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
4. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

M. Control Valves:
1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed and 100 percent open at proper air pressures.
3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
4. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

N. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

3.10 DDC SYSTEM CONTROLLER CHECKOUT
A. Verify power supply.
1. Verify voltage, phase and hertz.
2. Verify that protection from power surges is installed and functioning.
3. Verify that ground fault protection is installed.
4. If applicable, verify if connected to UPS unit.
5. If applicable, verify if connected to a backup power source.
6. If applicable, verify that power conditioning units, transient voltage suppression and high-frequency noise filter units are installed.

B. Verify that wire and cabling is properly secured to terminals and labeled with unique identification.

C. Verify that spare I/O capacity is provided.

3.11 DDC CONTROLLER I/O CONTROL LOOP TESTS
A. Testing:
1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
2. Test every I/O point throughout its full operating range.
3. Test every control loop to verify operation is stable and accurate.
4. Adjust control loop proportional, integral and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
5. Test and adjust every control loop for proper operation according to sequence of operation.
6. Test software and hardware interlocks for proper operation. Correct deficiencies.
7. Operate each analog point at the following:
a. Upper quarter of range.
b. Lower quarter of range.
c. At midpoint of range.

8. Exercise each binary point.
9. For every I/O point in DDC system, read and record each value at operator workstation, at DDC controller and at field instrument simultaneously. Value displayed at operator workstation, at DDC controller and at field instrument shall match.
10. Prepare and submit a report documenting results for each I/O point in DDC system and include in each I/O point a description of corrective measures and adjustments made to achieve desire results.

### 3.12 DDC SYSTEM VALIDATION TESTS

A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.

B. After approval of Test Plan, execute all tests and procedures indicated in plan.

C. After testing is complete, submit completed test checklist.

D. Pretest Checklist: Submit the following list with items checked off once verified:

1. Detailed explanation for any items that are not completed or verified.
2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
3. HVAC equipment motors operate below full-load amperage ratings.
4. Required DDC system components, wiring, and accessories are installed.
5. Installed DDC system architecture matches approved Drawings.
6. Control electric power circuits operate at proper voltage and are free from faults.
7. Required surge protection is installed.
8. DDC system network communications function properly, including uploading and downloading programming changes.
9. Using BACnet protocol analyzer, verify that communications are error free.
10. Each controller's programming is backed up.
11. Equipment, products, tubing, wiring cable and conduits are properly labeled.
12. All I/O points are programmed into controllers.
13. Testing, adjusting and balancing work affecting controls is complete.
14. Dampers and actuators zero and span adjustments are set properly.
15. Each control damper and actuator goes to failed position on loss of power.
16. Valves and actuators zero and span adjustments are set properly.
17. Each control valve and actuator goes to failed position on loss of power.
18. Meter, sensor and transmitter readings are accurate and calibrated.
19. Control loops are tuned for smooth and stable operation.
20. View trend data where applicable.
21. Each controller works properly in standalone mode.
22. Safety controls and devices function properly.
23. Interfaces with fire-alarm system function properly.
24. Electrical interlocks function properly.
25. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphic are created.
26. Record Drawings are completed.
3.13 FINAL REVIEW

A. Submit written request to Construction Manager when DDC system is ready for final review. Written request shall state the following:

1. DDC system has been thoroughly inspected for compliance with contract documents and found to be in full compliance.
2. DDC system has been calibrated, adjusted and tested and found to comply with requirements of operational stability, accuracy, speed and other performance requirements indicated.
3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Review by Construction Manager shall be made after receipt of written request. A field report shall be issued to document observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Should more than two reviews be required, DDC system manufacturer and Installer shall compensate entity performing review for total costs, labor and expenses, associated with third and subsequent reviews. Estimated cost of each review shall be submitted and approved by DDC system manufacturer and Installer before making the review.

E. Prepare and submit closeout submittals when no deficiencies are reported.

F. A part of DDC system final review shall include a demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration shall include, but not be limited to, the following:

   a. Accuracy and calibration of 10 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
   b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to 10 I/O points shall be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
   c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
   d. Operation of randomly selected dampers and valves in normal-on, normal-off and failed positions.
   e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
f. Trends, summaries, logs and reports set-up for Project.
g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at start points and respond to changes in set point of 20 percent or more.
h. Software's ability to communicate with controllers, operator workstations, uploading and downloading of control programs.
i. Software's ability to edit control programs off-line.
j. Data entry to show Project-specific customizing capability including parameter changes.
k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
l. Execution of digital and analog commands in graphic mode.
m. Spreadsheet and curve plot software and its integration with database.
n. Online user guide and help functions.
o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
p. System speed of response compared to requirements indicated.
q. For Each Programmable Application Controller:

1) Memory: Programmed data, parameters, trend and alarm history collected during normal operation is not lost during power failure.
2) Operator Interface: Ability to connect directly to each type of digital controller with a portable workstation and mobile device. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
4) Electric Power: Ability to disconnect any controller safely from its power source.
5) Wiring Labels: Match control drawings.
6) Network Communication: Ability to locate a controller's location on network and communication architecture matches Shop Drawings.
7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators and devices.
r. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Use ASHRAE 135 protocol analyzer to help identify devices, view network traffic, and verify interoperability. Requirements must be met even if only one manufacturer's equipment is installed.

1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
3) Set Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated. Modifications are made with messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.
4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.

5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.

6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.

7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.

8) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.

9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.

10) Device and Network Management:
   a) Display of network device status.
   b) Display of BACnet Object Information.
   c) Silencing devices transmitting erroneous data.
   d) Time synchronization.
   e) Remote device re-initialization.
   f) Backup and restore network device programming and master database(s).
   g) Configuration management of routers.

s. Insert additional requirements.

3.14 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.15 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by DDC system manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.16 DEMONSTRATION

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.
B. Extent of Training:

1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
3. Minimum Training Requirements:
   a. Provide not less than five days of training total.
   b. Stagger training over multiple training classes to accommodate Owner's requirements. All training shall occur before end of warranty period.
   c. Total days of training shall be broken into not more than two separate training classes.
   d. Each training class shall be not less than one consecutive day(s).

C. Training Schedule:

1. Schedule training with Owner 20 business days before expected Substantial Completion.
2. Schedule training to provide Owner with at least 10 business days of notice in advance of training.
3. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet:

1. Request from Owner in advance of training a proposed attendee list with name, phone number and e-mail address.
2. Provide a preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
3. Preprinted sign-in sheet shall include training session number, date and time, instructor name, phone number and e-mail address, and brief description of content to be covered during session. List attendees with columns for name, phone number, e-mail address and a column for attendee signature or initials.
4. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
5. At end of each training day, send Owner an e-mail with an attachment of scanned copy (PDF) of circulated sign-in sheet for each session.

E. Training Attendee Headcount:

1. Plan in advance of training for five attendees.
2. Make allowance for Owner to add up to two attendee(s) at time of training.
3. Headcount may vary depending on training content covered in session. Attendee access may be restricted to some training content for purposes of maintaining system security.

F. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of all training materials and visual presentations.
2. Hard-copy materials shall be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of all hard-copy materials.

G. Instructor Requirements:

1. One or multiple qualified instructors, as required, to provide training.
2. Instructors shall have not less than five years of providing instructional training on not less than five past projects with similar DDC system scope and complexity to DDC system installed.

H. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:
   a. Daily operators.
   b. Advanced operators.
   c. System managers and administrators.

2. Plan and organize training sessions to group training content to protect DDC system security. Some attendees may be restricted to some training sessions that cover restricted content for purposes of maintaining DDC system security.

I. Training Outline:

1. Submit training outline for Owner review at least 10 business day before scheduling training.
2. Outline shall include a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session and synopses for each lesson planned.

J. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power and data connectivity for instructor and each attendee.
2. Instructor shall provide training materials, projector and other audiovisual equipment used in training.
3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. On-site training shall include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration and service requirements.
5. Operator workstation provided with DDC system shall be used in training. If operator workstation is not indicated, provide a temporary workstation to convey training content.

K. Training Content for Daily Operators:

1. Basic operation of system.
2. Understanding each unique product type installed including performance and service requirements for each.
3. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm and each unique optimization routine.

4. Accessing data from DDC controllers.

5. Executing digital and analog commands in graphic mode.

6. Demonstrating control loop precision and stability via trend logs of I/O for not less than 10 percent of I/O installed.

7. Demonstrating DDC system performance through trend logs and command tracing.

8. Demonstrating scan, update, and alarm responsiveness.


10. Demonstrating on-line user guide, and help function and mail facility.

11. Demonstrating the following for HVAC systems and equipment controlled by DDC system:

   a. Operation of HVAC equipment in normal-off, -on and failed conditions while observing individual equipment, dampers and valves for correct position under each condition.

   b. Sharing of previously graphed trends of all control loops to demonstrate that each control loop is stable and set points are being maintained.

L. Video of Training Sessions:

1. Provide a digital video and audio recording of each training session. Create a separate recording file for each session.

2. Stamp each recording file with training session number, session name and date.

3. Provide Owner with two copies of digital files on DVDs or flash drives for later reference and for use in future training.

4. Owner retains right to make additional copies for intended training purposes without having to pay royalties.

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 control valves and actuators for DDC systems.

B. Related Requirements:

   1. Section 230923 "Direct Digital Control (DDC) System for HVAC" control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

1.3 DEFINITIONS

A. Cv: Design valve coefficient.

B. DDC: Direct-digital control.

C. NBR: Nitrile butadiene rubber.

D. PTFE: Polytetrafluoroethylene

E. RMS: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
   4. Installation, operation, and maintenance instructions, including factors affecting performance.
B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Include diagrams for pneumatic signal and main air tubing.

C. Delegated-Design Submittal:

1. Schedule and design calculations for control valves and actuators, including the following:
   a. Flow at project design and minimum flow conditions.
   b. Pressure differential drop across valve at project design flow condition.
   c. Maximum system pressure differential drop (pump close-off pressure) across valve at project minimum flow condition.
   d. Design and minimum control valve coefficient with corresponding valve position.
   e. Maximum close-off pressure.
   f. Leakage flow at maximum system pressure differential.
   g. Torque required at worst case condition for sizing actuator.
   h. Actuator selection indicating torque provided.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Control valve installation location shown in relationship to room, duct, pipe, and equipment.
2. Size and location of wall access panels for control valves installed behind walls.
3. Size and location of ceiling access panels for control valves installed above inaccessible ceilings.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For control valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

C. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

D. Backup Power Source: Systems and equipment served by a backup power source shall have associated control valve actuators served from a backup power source.

E. Environmental Conditions:
   1. Provide electric control valve actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Electric control valve actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.

F. Determine control valve sizes and flow coefficients by ISA 75.01.01.

G. Control valve characteristics and rangeability shall comply with ISA 75.11.01.
   1. Control valve shutoff classifications shall be FCI 70-2, Class IV or better unless otherwise indicated.
   2. Valve pattern, three-way or straight through, shall be as indicated on Drawings.
   3. Modulating straight-through pattern control valves shall have equal percentage flow-throttling characteristics unless otherwise indicated.
   4. Modulating three-way pattern water valves shall have linear flow-throttling characteristics. The total flow through the valve shall remain constant regardless of the valve's position.
   5. Selection shall consider viscosity, flashing, and cavitation corrections.
   6. Valves shall have stable operation throughout full range of operation, from design to minimum Cv.
   7. Minimum Cv shall be calculated at 10 percent of design flow, with a coincident pressure differential equal to the system design pump head.
   8. In water systems, select modulating control valves at terminal equipment for a design Cv based on a pressure drop of 7 psig at design flow unless otherwise indicated.
   9. Modulating valve sizes for steam service shall provide a pressure drop at design flow equal to lesser of the following:
      a. 50 percent of the valve inlet pressure.
      b. 50 percent of the absolute steam pressure at the valve inlet.
   10. Two-position control valves shall be line size unless otherwise indicated.
   11. In water systems, use ball- or globe-style control valves for two-position control for valves NPS 2 and smaller and butterfly style for valves larger than NPS 2.
   12. In steam systems, use ball- or globe-style control valves regardless of size.
   13. Pneumatic, two-position control valves shall provide a smooth opening and closing characteristic slow enough to avoid water hammer. Valves with pneumatic actuators shall have an adjustable opening time (valve full closed to full open) and an adjustable closing time (valve full open to full closed) ranging from zero to 10 seconds. Opening and closing times shall be independently adjustable.
   14. Control valve, pneumatic-control signal shall not exceed 200 feet. For longer distances, provide an electric/electronic control signal to the valve and an electric solenoid valve or electro-pneumatic transducer at the valve to convert the control signal to pneumatic.
2.2 BALL-STYLE CONTROL VALVES

A. Ball Valves with Two Ports and Characterized Disk:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Belimo Aircontrols (USA), Inc.
   b. Griswold Controls.
   c. HCI; Hydronics Components Inc.
   d. Siemens Industry, Inc. (Building Technologies Division).

2. Pressure Rating for NPS 1 and Smaller: Nominal 600 WOG.
3. Pressure Rating for NPS 1-1/2 through NPS 2: Nominal 400 WOG.
5. Process Temperature Range: Zero to 212 deg F.
7. End Connections: Threaded (NPT) ends.
8. Ball: Chrome-plated brass or bronze or 300 series stainless steel.
9. Stem and Stem Extension:
   a. Material to match ball.
   b. Blowout-proof design.
   c. Sleeve or other approved means to allow valve to be opened and closed without damaging the insulation or the vapor barrier seal.

10. Ball Seats: Reinforced PTFE.
11. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.
13. Flow Characteristics for B-Port: Modified for constant common port flow.

B. Pressure-Independent Ball Valves NPS 2 and Smaller:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Belimo Aircontrols (USA), Inc.
   b. Griswold Controls.
   c. HCI; Hydronics Components Inc.
   d. Siemens Industry, Inc. (Building Technologies Division).

2. Performance:
   a. Pressure Rating: 600 psig for NPS 1 and 400 psig for NPS 1-1/2 and NPS 2.
   b. Close-off pressure of 200 psig.
   c. Process Temperature Range: Between zero to 212 deg F.
   d. Rangeability: 100 to 1.

3. Integral Pressure Regulator: Located upstream of ball to regulate pressure, to maintain a constant pressure differential while operating within a pressure differential range of 5 to 50 psig.
5. Ball: Chrome-plated brass.
7. Stem sleeve or other approved means to allow valve to be opened and closed without damaging field-applied insulation and insulation vapor barrier seal.
8. Ball Seats: Reinforced PTFE.
9. Stem Seal: Reinforced PTFE packing ring stem seal with threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if equivalent cycle endurance can be achieved.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Examine roughing-in for valves installed in piping to verify actual locations of piping connections before installation.
   C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
   D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL
   A. Furnish and install products required to satisfy most stringent requirements indicated.
   B. Install products level, plumb, parallel, and perpendicular with building construction.
   C. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
   D. Firestop penetrations made in fire-rated assemblies and seal penetrations made in acoustically rated assemblies.
   E. Fastening Hardware:
      1. Stillson wrenches, pliers, and other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
      2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
      3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.
F. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.3 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 CONTROL VALVES

A. Install pipe reducers for valves smaller than line size. Position reducers as close to valve as possible but at distance to avoid interference and impact to performance. Install with manufacturer-recommended clearance.

B. Install flanges or unions to allow drop-in and -out valve installation.

C. Valve Orientation:
   1. Where possible, install globe and ball valves installed in horizontal piping with stems upright and not more than 15 degrees off of vertical, not inverted.
   2. Install valves in a position to allow full stem movement.
   3. Where possible, install butterfly valves that are installed in horizontal piping with stems in horizontal position and with low point of disc opening with direction of flow.

D. Clearance:
   1. Locate valves for easy access and provide separate support of valves that cannot be handled by service personnel without hoisting mechanism.
   2. Install valves with at least 12 inches of clear space around valve and between valves and adjacent surfaces.

E. Threaded Valves:
   1. Note internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
   2. Align threads at point of assembly.
   3. Apply thread compound to external pipe threads, except where dry seal threading is specified.
   4. Assemble joint, wrench tight. Apply wrench on valve end as pipe is being threaded.

3.5 CONNECTIONS

A. Connect electrical devices and components to electrical grounding system. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with valve identification on valve and on face of ceiling directly below valves concealed above ceilings.

3.7 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing.

C. Polish glossy surfaces to a clean shine.

3.8 CHECKOUT PROCEDURES

A. Control Valve Checkout:

1. Check installed products before continuity tests, leak tests, and calibration.
2. Check valves for proper location and accessibility.
3. Check valves for proper installation for direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
4. Verify that control valves are installed correctly for flow direction.
5. Verify that valve body attachment is properly secured and sealed.
6. Verify that valve actuator and linkage attachment are secure.
7. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
8. Verify that valve ball, disc, and plug travel are unobstructed.
9. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

3.9 ADJUSTMENT, CALIBRATION, AND TESTING

A. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

B. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressures.

C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.
D. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.
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 the following types of control dampers and actuators for DDC systems:

1. Rectangular control dampers.
2. Round control dampers.
3. General control-damper actuator requirements.
4. Electric and electronic actuators.

B. Related Requirements:

1. Section 230923 "Direct-Digital Control System for HVAC" for control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

1.3 DEFINITIONS

A. DDC: Direct-digital control.

B. RMS: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
4. Installation instructions, including factors affecting performance.

B. Shop Drawings:
1. Include plans, elevations, sections, and details.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Include diagrams for air and process signal tubing.
5. Include diagrams for pneumatic signal and main air tubing.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Product installation location shown in relationship to room, duct, and equipment.
2. Size and location of wall access panels for control dampers and actuators installed behind walls.
3. Size and location of ceiling access panels for control dampers and actuators installed above inaccessible ceilings.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For control dampers to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

C. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

D. Backup Power Source: Systems and equipment served by a backup power source shall have associated control damper actuators served from a backup power source.

E. Environmental Conditions:

1. Provide electric control-damper actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Electric control-damper actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.

2.2 RECTANGULAR CONTROL DAMPERS

A. General Requirements:

1. Unless otherwise indicated, use parallel blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed blade configuration.
2. Factory assemble multiple damper sections to provide a single damper assembly of size required by the application.
3. Damper actuator shall be factory installed by damper manufacturer as integral part of damper assembly. Coordinate actuator location and mounting requirements with damper manufacturer.

B. Rectangular Dampers with Aluminum Airfoil Blades:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Arrow United Industries.
   b. Ruskin Company.
2. Performance:
   a. Leakage: AMCA 511, Class 1A. Leakage shall not exceed 3 cfm/sq. ft. against 1-in. wg differential static pressure.
   b. Pressure Drop: 0.05-in. wg at 1500 fpm across a 24-by-24-inch damper when tested according to AMCA 500-D, figure 5.3.
   c. Velocity: Up to 6000 fpm.
   d. Temperature: Minus 40 to plus 185 deg F.
   e. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
   f. Damper shall have AMCA seal for both air leakage and air performance.
3. Construction:
   a. Frame:
      1) Material: ASTM B211, Alloy 6063 T5 extruded-aluminum profiles, 0.07 inch thick.
      2) Hat-shaped channel with integral flange(s). Mating face shall be a minimum of 1 inch.
      3) Width not less than 5 inches.
   b. Blades:
      1) Hollow, airfoil, extruded aluminum.
      2) Parallel or opposed blade configuration as required by application.
      3) Material: ASTM B211, Alloy 6063 T5 aluminum, 0.07 inch thick.
      4) Width not to exceed 6 inches.
      5) Length as required by close-off pressure, not to exceed 48 inches.
   c. Seals:
1) Blades: Replaceable, mechanically attached extruded silicone, vinyl, or plastic composite.
2) Jambs: Stainless steel, compression type.

d) Axles: 0.5-inch-diameter plated or stainless steel, mechanically attached to blades.

e) Bearings:
   1) Molded synthetic or stainless-steel sleeve mounted in frame.
   2) Where blade axles are installed in vertical position, provide thrust bearings.

f) Linkage:
   1) Concealed in frame.
   2) Constructed of aluminum and plated or stainless steel.
   3) Hardware: Stainless steel.

g) Transition:
   1) For round and flat oval duct applications, provide damper assembly with integral transitions to mate to adjoining field connection.
   2) Factory mount damper in a sleeve with a close transition to mate to field connection.
   3) Damper size and sleeve shall be connection size plus 2 inches.
   4) Sleeve length shall be not less than 12 inches for dampers without jackshafts and shall be not less than 16 inches for dampers with jackshafts.
   5) Sleeve material shall match adjacent duct.

h) Additional Corrosion Protection for Corrosive Environments:
   1) Provide anodized finish for aluminum surfaces in contact with airstream. Anodized finish shall be a minimum of 0.0007 inch thick.
   2) Axles, damper linkage, and hardware shall be constructed of Type 316L stainless steel.

C. Rectangular Dampers with Steel Airfoil Blades:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Ruskin Company.

2. Performance:
   a. Leakage: AMCA 511, Class 1A. Leakage shall not exceed 3 cfm/sq. ft. against 1-in. wg differential static pressure.
   b. Pressure Drop: 0.06-in. wg at 1500 fpm across a 24-by-24-inch damper when tested according to AMCA 500-D, figure 5.3.
   c. Velocity: Up to 6000 fpm.
   d. Temperature: Minus 40 to plus 185 deg F.
   e. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
   f. Damper shall have AMCA seal for both air leakage and air performance.
3. Construction:
   a. Frame:
      1) Material: ASTM A653/A653M galvanized-steel profiles, 0.06 inch thick.
      2) Hat-shaped channel with integral flanges. Mating face shall be a minimum of 1 inch.
      3) Width not less than 5 inches.
   b. Blades:
      1) Hollow, airfoil, galvanized steel.
      2) Parallel or opposed blade configuration as required by application.
      3) Material: ASTM A653/A653M galvanized steel, 0.05 inch thick.
      4) Width not to exceed 6 inches.
      5) Length as required by close-off pressure, not to exceed 48 inches.
   c. Seals:
      1) Blades: Replaceable, mechanically attached extruded silicone, vinyl, or plastic composite.
      2) Jambs: Stainless steel, compression type.
   d. Axles: 0.5-inch- diameter plated or stainless steel, mechanically attached to blades.
   e. Bearings:
      1) Stainless steel mounted in frame.
      2) Where blade axles are installed in vertical position, provide thrust bearings.
   f. Linkage:
      1) Concealed in frame.
      2) Constructed of aluminum and plated or stainless steel.
      3) Hardware: Stainless steel.
   g. Transition:
      1) For round and flat oval duct applications, provide damper assembly with integral transitions to mate to adjoining field connection.
      2) Factory mount damper in a sleeve with a close transition to mate to field connection.
      3) Damper size and sleeve shall be connection size plus 2 inches.
      4) Sleeve length shall be not less than 12 inches for dampers without jackshafts and shall be not less than 16 inches for dampers with jackshafts.
      5) Sleeve material shall match adjacent duct.
   h. Additional Corrosion Protection for Corrosive Environments:
      1) Provide epoxy finish for surfaces in contact with airstream.
      2) Axles, damper linkage, and hardware shall be constructed of Type 316L stainless steel.
2.3 GENERAL CONTROL-DAMPER ACTUATORS REQUIREMENTS

A. Actuators shall operate related damper(s) with sufficient reserve power to provide smooth modulating action or two-position action and proper speed of response at velocity and pressure conditions to which the damper is subjected.

B. Actuators shall produce sufficient power and torque to close off against the maximum system pressures encountered. Actuators shall be sized to close off against the fan shutoff pressure as a minimum requirement.

C. The total damper area operated by an actuator shall not exceed 80 percent of manufacturer's maximum area rating.

D. Provide one actuator for each damper assembly where possible. Multiple actuators required to drive a single damper assembly shall operate in unison.

E. Avoid the use of excessively oversized actuators which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.

F. Use jackshafts and shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.

G. Provide mounting hardware and linkages for connecting actuator to damper.

H. Select actuators to fail in desired position in the event of a power failure.

I. Actuator Fail Positions: See Drawings.

2.4 ELECTRIC AND ELECTRONIC ACTUATORS

A. Type: Motor operated, with or without gears, electric and electronic.

B. Voltage:
   1. Voltage selection is delegated to professional designing control system 24 V.
   2. Actuator shall deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.
   3. Actuator shall function properly within a range of 85 to 120 percent of nameplate voltage.

C. Construction:
   1. Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
   2. 100 up to 400 W: Gears ground steel, oil immersed, shaft-hardened steel running in bronze, copper alloy, or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel, or cast-aluminum housing.

D. Field Adjustment:
1. Spring return actuators shall be easily switchable from fail open to fail closed in the field without replacement.
2. Provide gear-type actuators with an external manual adjustment mechanism to allow manual positioning of the damper when the actuator is not powered.

E. Modulating Actuators:

1. Capable of stopping at all points across full range, and starting in either direction from any point in range.
2. Control Input Signal:
   a. Three Point, Tristate, or Floating Point: Clockwise and counter-clockwise inputs. One input drives actuator to open position, and other input drives actuator to close position. No signal of either input remains in last position.
   b. Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for zero- to 10- or 2- to 10-V dc and 4- to 20-mA signals.
   c. Pulse Width Modulation (PWM): Actuator drives to a specified position according to a pulse duration (length) of signal from a dry-contact closure, triac sink or source controller.
   d. Programmable Multi-Function:
      1) Control input, position feedback, and running time shall be factory or field programmable.
      2) Diagnostic feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
      3) Service data, including at a minimum, number of hours powered and number of hours in motion.

F. Position Feedback:

1. Equip two-position actuators with limits switches or other positive means of a position indication signal for remote monitoring of open and close position.
2. Equip Where indicated, equip modulating actuators with a position feedback through current or voltage signal for remote monitoring.
3. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.

G. Fail-Safe:

1. Where indicated, provide actuator to fail to an end position.
2. Internal spring return mechanism to drive controlled device to an end position (open or close) on loss of power.
3. Batteries, capacitors, and other non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.

H. Integral Overload Protection:

1. Provide against overload throughout the entire operating range in both directions.
2. Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.

I. Damper Attachment:
1. Unless otherwise required for damper interface, provide actuator designed to be directly coupled to damper shaft without need for connecting linkages.
2. Attach actuator to damper drive shaft in a way that ensures maximum transfer of power and torque without slippage.
3. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.

J. Temperature and Humidity:
1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F.
2. Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, non-condensing.

K. Stroke Time:
1. Operate damper from fully closed to fully open within 15 seconds.
2. Operate damper from fully open to fully closed within 15 seconds.
3. Move damper to failed position within 5 seconds.
4. Select operating speed to be compatible with equipment and system operation.
5. Actuators operating in smoke control systems comply with governing code and NFPA requirements.

L. Sound:
1. Spring Return: 62 dBA.
2. Non-Spring Return: 45 dBA.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for dampers and instruments installed in duct systems to verify actual locations of connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

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

3.2 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Properly support dampers and actuators, tubing, wiring, and conduit to comply with requirements indicated.
C. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

D. Seal penetrations made in fire-rated and acoustically rated assemblies.

E. Fastening Hardware:
   1. Stillson wrenches, pliers, or other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
   2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
   3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

F. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.3 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.4 CONTROL DAMPERS

A. Install smooth transitions, not exceeding 30 degrees, to dampers smaller than adjacent duct. Install transitions as close to damper as possible but at distance to avoid interference and impact to performance. Consult manufacturer for recommended clearance.

B. Clearance:
   1. Locate dampers for easy access and provide separate support of dampers that cannot be handled by service personnel without hoisting mechanism.
   2. Install dampers with at least 24 inches of clear space on sides of dampers requiring service access.

C. Service Access:
   1. Dampers and actuators shall be accessible for visual inspection and service.
2. Install access door(s) in duct or equipment located upstream of damper to allow service personnel to hand clean any portion of damper, linkage, and actuator. Comply with requirements in Section 233300 "Air Duct Accessories."

D. Install dampers straight and true, level in all planes, and square in all dimensions. Install supplementary structural steel reinforcement for large multiple-section dampers if factory support alone cannot handle loading.

E. Attach actuator(s) to damper drive shaft.

F. For duct-mounted and equipment-mounted dampers installed outside of equipment, install a visible and accessible indication of damper position from outside.

3.5 CONNECTIONS

A. Connect electrical devices and components to electrical grounding system. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 CHECKOUT PROCEDURES

A. Control-Damper Checkout:

1. Check installed products before continuity tests, leak tests, and calibration.
2. Check dampers for proper location and accessibility.
3. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.
4. For pneumatic products, verify air supply for each product is properly installed.
5. For pneumatic dampers, verify that pressure gages are provided in each air line to damper actuator and positioner.
6. Verify that control dampers are installed correctly for flow direction.
7. Verify that proper blade alignment, either parallel or opposed, has been provided.
8. Verify that damper frame attachment is properly secured and sealed.
9. Verify that damper actuator and linkage attachment are secure.
10. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
11. Verify that damper blade travel is unobstructed.

3.8 ADJUSTMENT, CALIBRATION, AND TESTING:

A. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.
B. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressure.

C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.

D. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

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 pipe and fitting materials and joining methods for the following:

1. Copper tube and fittings.
2. Steel pipe and fittings.
3. Plastic pipe and fittings.
4. Fiberglass pipe and fittings.
5. Joining materials.
6. Transition fittings.
7. Dielectric fittings.
8. Bypass chemical feeder.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Pipe.
2. Fittings.
4. Bypass chemical feeder.

B. Sustainable Design Submittals:

C. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Field quality-control reports.

D. Preconstruction Test Reports:
1. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
2. Fiberglass Pipe and Fitting Installers: Installers of RTRF and RTRP shall be certified by manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Chilled-Water Piping: 150 psig at 73 deg F.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Copper or Bronze Pressure-Seal Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkhart Products Corporation.
      b. Mueller Industries, Inc.
      c. NIBCO INC.
      d. Viega LLC.
   2. Housing: Copper.
   3. O-Rings and Pipe Stops: EPDM.
   4. Tools: Manufacturer's special tools.
   5. Minimum 200-psig working-pressure rating at 250 deg F.

E. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. T-DRILL Industries Inc.

F. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.


D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
2. End Connections: Butt welding.
3. Facings: Raised face.

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 otherwise 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. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 TRANSITION FITTINGS

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A.Y. McDonald Mfg. Co.
      b. Capitol Manufacturing Company.
      c. Central Plastics Company.
      d. HART Industrial Unions, LLC.
      e. WATTS.
      f. Wilkins.
      g. Zurn Industries, LLC.

2. Description:

b. Pressure Rating: 125 psig minimum at 180 deg F.

c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements;

   a. Elster Perfection Corporation.
   b. Grinnell G-Fire by Johnson Controls Company.
   c. Matco-Norca.
   d. Precision Plumbing Products.

2. Description:

   b. Electroplated steel nipple, complying with ASTM F 1545.
   c. Pressure Rating: 300 psig at 225 deg F.
   d. End Connections: Male threaded or grooved.
   e. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Schedule 40, Grade B steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Chilled-water piping, aboveground, NPS 2 and smaller, shall be the following:

   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered brazed joints.
   2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

C. Air-Vent Piping:

   1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
   2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

D. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
3.2 PIPING INSTALLATION

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 piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to the following:
   1. Section 230523.12 "Ball Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

C. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

D. Install hangers for copper tubing and steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Install hangers for plastic piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Install hangers for fiberglass piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support horizontal piping within 12 inches of each fitting and coupling.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B813, 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.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

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. **Welded Joints:** Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to “Quality Assurance” Article.

G. **Flanged Joints:** Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

### 3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Double-wall round ducts and fittings.
4. Sheet metal materials.
5. Duct liner.
7. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

1.3 DEFINITIONS

A. OSHPD: Office of Statewide Health Planning and Development (State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For sealants, indicating VOC content.
4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   4. Elevation of top of ducts.
   5. Fittings.
   6. Reinforcement and spacing.
   7. Seam and joint construction.
   8. Penetrations through fire-rated and other partitions.
   9. Equipment installation based on equipment being used on Project.
  10. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
  11. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

D. Delegated-Design Submittal:
   1. Sheet metal thicknesses.
   2. Joint and seam construction and sealing.
   3. Reinforcement details and spacing.
   4. Materials, fabrication, assembly, and spacing of hangers and supports.
   5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible". Seismically brace duct hangers and supports in accordance with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems - OSHPD Edition."

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.

C. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. Sealant shall have a VOC content of 420 g/L or less.
11. Sealant shall comply with the testing and product requirements of the California Department of Public Health’s "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.7 SEISMIC-RESTRAINT DEVICES

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

1. Atkore International (Unistrut).
2. Ductmate Industries, Inc.
3. Eaton (B-line).
4. Elgen Manufacturing.
5. Hilti, Inc.
7. Mason Industries, Inc.
8. nVent (CADDY).

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A603, galvanized-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E488/E488M.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.


L. Elbows: Use long-radius elbows wherever they fit.
   1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
   2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

M. Branch Connections: Use lateral or conical branch connections.

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
   3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
   4. Unconditioned Space, Exhaust Ducts: Seal Class C.
   5. Unconditioned Space, Return-Air Ducts: Seal Class B.
   6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
   7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
   8. Conditioned Space, Exhaust Ducts: Seal Class B.
   9. Conditioned Space, Return-Air Ducts: Seal Class C.
3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA’s "Seismic Restraint Manual: Guidelines for Mechanical Systems."

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
G. Drilling for and Setting Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Set anchors to manufacturer's recommended torque, using a torque wrench.
   5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.5 CONNECTIONS
   A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
   B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.
   C. Duct System Cleanliness Tests:
      1. Visually inspect duct system to ensure that no visible contaminants are present.
      2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
         a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
   D. Duct system will be considered defective if it does not pass tests and inspections.

3.6 STARTUP
   A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE
   A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
      1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
B. Supply Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive 2-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.
   2. Ducts Connected to Equipment Not Listed Above:
      a. Pressure Class: Positive 2-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.

C. Return Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units Insert equipment:
      a. Pressure Class: Positive or negative 1-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.

D. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 2-inch wg.
      b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
   1. Ducts Connected to Equipment Not Listed Above:
      a. Pressure Class: Positive or negative 2-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.

F. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

G. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Conical spin in.
   2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
      a. Velocity 1000 fpm or Lower: 90-degree tap.
      b. Velocity 1000 to 1500 fpm: Conical tap.
      c. Velocity 1500 fpm or Higher: 45-degree lateral.

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:
   2. Control dampers.

B. Related Requirements:
   1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. 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:
      b. Control-damper installations.
      c. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.
1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION


B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

B. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

C. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance; a division of MESTEK, Inc.
   b. Aire Technologies.
   c. American Warming and Ventilating; a Mestek Architectural Group company.
   d. Arrow United Industries.
   e. Cesco Products; a division of MESTEK, Inc.
f. Nailor Industries Inc.
g. Pottorff.
h. Ruskin Company.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Frame: Hat-shaped, 0.094-inch thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch thick.

7. Bearings:
   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance; a division of MESTEK, Inc.
   b. American Warming and Ventilating; a Mestek Architectural Group company.
   c. Arrow United Industries.
   d. Cesco Products; a division of MESTEK, Inc.
   e. Greenheck Fan Corporation.
   f. Nailor Industries Inc.
   g. Pottorff.
   h. Ruskin Company.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:
   a. 0.094-inch thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
6. **Blades:**
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized, roll-formed steel, 0.064 inch thick.

7. **Blade Axles:** Galvanized steel.

8. **Bearings:**
   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. **Blade Seals:** Neoprene.

10. **Jamb Seals:** Cambered aluminum.

11. **Tie Bars and Brackets:** Galvanized steel.

12. **Accessories:**
   a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. **Damper Hardware:**
   2. Include center hole to suit damper operating-rod size.
   3. Include elevated platform for insulated duct mounting.

2.4 **FLEXIBLE CONNECTORS**

A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   1. CL WARD & Family Inc.
   2. Ductmate Industries, Inc.
   3. Duro Dyne Inc.
   4. DynAir; a Carlisle Company.
   5. Elgen Manufacturing.
   6. Ventfabrics, Inc.
   7. Ward Industries; a brand of Hart & Cooley, Inc.

B. **Materials:** Flame-retardant or noncombustible fabrics.

C. **Coatings and Adhesives:** Comply with UL 181, Class 1.

D. **Indoor System, Flexible Connector Fabric:** Glass fabric double coated with neoprene.
   1. Minimum Weight: 26 oz./sq. yd..
   2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.5 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

   1. Operate dampers to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed.
   3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

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. Non-insulated flexible ducts.
      2. Insulated flexible ducts.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: For flexible ducts.
      1. Include plans showing locations and mounting and attachment details.

1.4 INFORMATIONAL SUBMITTALS
   A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted
      access panels and access doors required for access to duct accessories are shown and
      coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION
   A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with
      NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
   B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for
      acceptable materials, material thicknesses, and duct construction methods unless otherwise
      indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains,
      discolorations, and other imperfections.
   C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
2.2 INSULATED FLEXIBLE DUCTS

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

1. Flexmaster U.S.A., Inc.
2. JP Lamborn Co.
3. McGill AirFlow LLC.
4. Thermaflex; a Flex-Tek Group company.
5. Ward Industries; a brand of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: Comply with ASHRAE/IES 90.1.

2.3 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install flexible ducts 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 in indoor applications only. Flexible ductwork should not be exposed to UV lighting.

C. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

D. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

E. Connect flexible ducts to metal ducts with adhesive liquid adhesive plus tape.

F. Install duct test holes where required for testing and balancing purposes.

G. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

H. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 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 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Square in-line centrifugal fans.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
   2. Rated capacities, operating characteristics, and furnished specialties and accessories.
   3. Certified fan performance curves with system operating conditions indicated.
   4. Certified fan sound-power ratings.
   5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   6. Material thickness and finishes, including color charts.
   7. Dampers, including housings, linkages, and operators.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
   4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Fan room layout and relationships between components and adjacent structural and mechanical elements, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: For fans, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity, and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in normal operation, emergency operation, and maintenance manuals with replacement parts listing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolators and supports.

B. Seismic Performance: Centrifugal fans shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Component Importance Factor: 1.5.

2.2 SQUARE IN-LINE CENTRIFUGAL FANS

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

B. Description: Square in-line centrifugal fans.
PART 3 - EXECUTION

3.1 DUCTWORK AND PIPING CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.2 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
   1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
   2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.3 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:
1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that there is adequate maintenance and access space.
4. Verify that cleaning and adjusting are complete.
5. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
6. Remove and replace malfunctioning units and retest as specified above.

F. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust damper linkages for proper damper operation.
B. Adjust belt tension.
C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
D. Replace fan and motor pulleys as required to achieve design airflow.
E. Lubricate bearings.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

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. Perforated diffusers.

B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
   2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
   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 Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Actual size of smallest diffuser indicated.

C. Samples for Initial Selection: For diffusers with factory-applied color finishes. Actual size of smallest diffuser indicated.

D. Samples for Verification: For diffusers, in manufacturer's standard sizes to verify color selected. Actual size of smallest diffuser indicated.

1.4 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORATED DIFFUSERS

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

1. Nailor Industries Inc.
2. Price Industries.
4. Titus, a division of Air System Components; Johnson Controls, Inc.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel backpan and pattern controllers, with steel face.

D. Finish: Baked enamel, white.

E. Face Size: 24 by 24 inches.

F. Duct Inlet: Round or Square.

G. Face Style: Flush.

H. Mounting: T-bar.

I. Pattern Controller: Adjustable with louvered pattern modules at inlet.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 **ADJUSTING**

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

**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. Fixed face registers and grilles.

B. Related Requirements:
   1. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   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. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Smallest size register and grille indicated.

C. Samples for Initial Selection: For registers and grilles with factory-applied color finishes. Smallest size register and grille indicated.

D. Samples for Verification: For registers and grilles, in manufacturer's standard sizes to verify color selected. Smallest size register and grille indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

B. Source quality-control reports.
PART 2 - PRODUCTS

2.1 REGISTERS

A. Fixed Face Register

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

   a. Nailor Industries Inc.
   b. Price Industries.
   d. Titus, a division of Air System Components; Johnson Controls, Inc.

3. Finish: Baked enamel, white.
5. Face Arrangement: Perforated core.
8. Mounting: Lay in.

2.2 GRILLES

A. Adjustable Blade Face Grille

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

   a. Nailor Industries Inc.
   b. Price Industries.

3. Finish: Baked enamel, white.
7. Mounting: Concealed Lay in.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

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. Ductless fan coil units and accessories.
   2. Ducted fan coil units and accessories.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, and furnished specialties and
      accessories.

B. Shop Drawings:
   1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required
      clearances, method of field assembly, components, and location and size of each field
      connection.
   2. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.
D. Samples for Verification: For each type of fan coil unit indicated.

1.4 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on
   which the following items are shown and coordinated with each other, based on input from
   installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members to which fan coil units will be attached.
   3. Method of attaching hangers to building structure.
   4. Size and location of initial access modules for acoustical tile.
   5. Items penetrating finished ceiling, including the following:
      a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.

B. Seismic Qualification Certificates: For fan coil units, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fan coil units to include in emergency, operation, and maintenance manuals.
   a. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fan Coil Unit Filters: Furnish 1 spare filters for each filter installed.
   2. Fan Belts: Furnish 1 spare fan belts for each unit installed.

1.7 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
1.8 COORDINATION

A. Coordinate layout and installation of fan coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate size and location of wall sleeves for outdoor-air intake.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Compressor failure.
   b. Condenser coil leak.

2. Warranty Period: Five years from date of Substantial Completion.
3. Warranty Period (Compressor Only): Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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. Factory-packaged and -tested units rated according to AHRI 440, ASHRAE 33, and UL 1995.

2.2 DUCTED FAN COIL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Carrier Corporation.
   2. Daikin Applied.
   3. Engineered Air.
   4. ENVIRO-TEC; by Johnson Controls, Inc.
   5. First Company Products.
   7. Nailor Industries Inc.

B. Fan Coil Unit Configurations: split.

1. Number of Heating Coils: One with two-pipe system.
2. Number of Cooling Coils: One with four-pipe system.

C. Coil Section Insulation: 1-inch thick, coated glass fiber complying with ASTM C1071 and attached with adhesive complying with ASTM C916.

1. Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.

2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

3. Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.

4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Main and Auxiliary Drain Pans: Stainless steel. Fabricate pans and drain connections to comply with ASHRAE 62.1.

E. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panel. Floor-mounting units shall have leveling screws.

F. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.

1. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis.

2. Return-Air Plenum: Sheet metal plenum finished to match the chassis.

3. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.

4. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.

G. Filters: Minimum arrestance and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 and all addendums.

H. MERV Rating: 8 when tested according to ASHRAE 52.2.

1. Pleated Cotton-Polyester Media: 90 percent arrestance and MERV 8

I. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

J. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.

K. DDC Terminal Controller:

1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.

2. Unoccupied-Period-Override Operation: Two hours.
3. **Unit Supply-Air Fan Operation:**
   a. Occupied Periods: Fan runs continuously.
   b. Unoccupied Periods: Fan cycles to maintain room setback temperature.

4. **Hydronic-Cooling-Coil Operation:**
   a. Occupied Periods: Modulate control valve to maintain room temperature.
   b. Unoccupied Periods: Close control valve.

5. **Heating-Coil Operation:**
   a. Occupied Periods: Modulate control valve to provide heating if room temperature falls below thermostat set point.

L. **Interface with DDC System for HVAC Requirements:**
   1. Interface relay for scheduled operation.
   2. Interface relay to provide indication of fault at the central workstation.
   3. Provide BACnet interface for central DDC system for HVAC workstation for the following functions:
      a. Adjust set points.
      b. Fan coil unit start, stop, and operating status.
      c. Data inquiry, including supply- and room-air temperature.
      d. Occupied and unoccupied schedules.

M. **Electrical Connection:** Factory wire motors and controls for a single electrical connection.

**PART 3 - EXECUTION**

3.1 **EXAMINATION**
   A. Examine areas, with Installer present, to receive fan coil units for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Examine roughing-in for piping and electrical connections to verify actual locations before fan coil unit installation.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 **INSTALLATION**
   A. Install fan coil units level and plumb.
   B. Install fan coil units to comply with NFPA 90A.
C. Suspend fan coil units from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.

E. Install new filters in each fan coil unit within two weeks after Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect piping to fan coil unit factory hydronic piping package. Install piping package if shipped loose.
3. Connect condensate drain to indirect waste.
   a. Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

B. Connect supply-air and return-air ducts to fan coil units with flexible duct connectors specified in Section 233300 "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.
3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fan coil units.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. This section applies to all sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system, and obtain electric utility company approval for sizes and settings of these devices.

D. Conductor amperages specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. The International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials
and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.

2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3. Certified: Materials and equipment which:
   a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
   b. Are periodically inspected by a NRTL.
   c. Bear a label, tag, or other record of certification.

4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer’s principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:
   1. Manufacturer’s materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
   2. The Owner reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Owner shall have the option of witnessing factory tests. The Contractor shall notify the Owner a minimum of 15 working days prior to the manufacturer’s performing the factory tests.
2. Four copies of certified test reports shall be furnished to the Owner two weeks prior to final inspection and not more than 90 days after completion of the tests.
3. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Owner to witness re-testing.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Owner or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

1. Electrical switchgear, generators, transformers rated 500kVA or larger, and factory assembled equipment shall be shipped to the site using shockwatch or equivalent impact indicators on each shipping unit.
2. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
3. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
4. Damaged equipment shall be repaired or replaced, as determined by the COR.
5. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
6. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.
1.9 WORK PERFORMANCE

A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:

1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the Owner. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COR.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working clearances shall not be less than specified in the NEC.

C. Inaccessible Equipment:

1. Where the Owner determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
2. “Readily accessible” is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company’s system shall conform to the electric utility
company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E-2015. Label shall indicate the Arc flash boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm²), site specific PPE level, PPE description (including glove rating), voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

1.12 SUBMITTALS

A. Submit to the Owner in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Owner's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Owner to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION__________________________".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.
E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.

2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.

3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.

4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.

2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.

3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.

4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation instructions.
   e. Safety precautions for operation and maintenance.
   f. Diagrams and illustrations.
   g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
   j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the Owner with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.

2. Each type of conduit coupling, bushing, and termination fitting.

3. Conduit hangers, clamps, and supports.

4. Duct sealing compound.

5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., “the switch”), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 POLYCHLORINATED BIPHENYL (PCB) EQUIPMENT

A. This project requires the removal, transport, and disposal of electrical equipment containing Polychlorinated Biphenyls (PCB) in accordance with the Federal Toxic Substances Control Act (TSCA).

B. The equipment to be removed is shown on the drawings.

C. The selective demolition shall be in accordance with Section 02 41 00, DEMOLITION.

1.15 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Owner.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Owner.

1.16 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Owner.
1.17 INSTRUCTION

A. Instruction to designated Owner personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the Owner at least 30 days prior to the planned training.

1.18 WORK PLAN

A. Before initiating any work, a job specific “work plan” must be developed by the Contractor with a review conducted and documented by the Owner. The work plan must include a complete schedule of work to be performed with time-lines for each task and when the equipment and systems are to be made available to the Owner after the completion of the work.

B. A description of each task identifying the location of the work with procedures to be used on and near the electrical equipment, barriers and access equipment (scaffolds, lifts, etc.) to be used, safety equipment to be used, and exit pathways shall be provided to and approved by the Owner before the commencement of the work.

C. Any electrical shut downs required shall be approved in advance as part of the work plan. A coordination meeting with the Owners designated representatives on the day of and prior to a shutdown shall be scheduled and addended by the Contractor. If electrical equipment and systems need to be made available when requested by the owner before the work is completed a “back-out plan” to be executed by the Contractor shall be developed and included in the “work plan” to be reviewed and approved by the Owner.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

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. Building wires and cables rated 600 V and less.
      2. Connectors, splices, and terminations rated 600 V and less.
   B. Related Requirements:
      1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems
         communications cables and Classes 1, 2 and 3 control cables.
      2. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data
         circuits.

1.3 DEFINITIONS
   A. VFC: Variable frequency controller.

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

1.5 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For testing agency.
   B. Field quality-control reports.

1.6 QUALITY ASSURANCE
   A. Testing Agency Qualifications: Member company of NETA or an NRTL.
      1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

1. Industrial Wire & Cable Inc.
2. Industrial Wire & Cable Inc.
3. Alpha Wire Company.
4. Belden Inc.
5. Cerro Wire LLC.
6. Cooper Industries, Inc.
8. General Cable Technologies Corporation.
9. General Cable; General Cable Corporation.
10. Senator Wire & Cable Company.
11. Service Wire Co.
13. Thomas & Betts Corporation, A Member of the ABB Group.

B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW-2, Type THHN/THWN-2, Type XHHW-2, Type UF, Type USE and Type SO.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

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

1. 3M.
2. AFC Cable Systems; a part of Atkore International.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSI Industries LLC.
8. O-Z/Gedney; a brand of Emerson Industrial Automation.
9. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
2.3 SYSTEM DESCRIPTION

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. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Drawings are based on copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.

F. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway, Type XHHW-2, single conductors larger than No. 1/0 AWG, Metal-clad cable, Type MC.

G. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway, Type XHHW-2, single conductors in raceway.

J. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC.
K. Branch Circuits in Cable Tray: Type THHN/THWN-2, single conductors in raceway, Type XHHW-2, single conductors larger than No. 1/0 AWG, Metal-clad cable, Type MC.

L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.
3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Coordinate with owner to perform tests and inspections.

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

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 grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Ground rods.
   2. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

      a. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.

         1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
         2) Include recommended testing intervals.
1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Framatome Connectors International.
2. Cooper Power Systems.
3. Burndy; Part of Hubbell Electrical Systems.
4. Dossert; AFL Telecommunications LLC.
5. ERICO International Corporation.
6. Fushi Copperweld Inc.
7. Galvan Industries, Inc.; Electrical Products Division, LLC.
8. Harger Lightning & Grounding.
9. ILSCO.
11. Robbins Lightning, Inc.
13. Thomas & Betts Corporation, A Member of the ABB Group.

2.2 SYSTEM DESCRIPTION

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.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches below grade.
   2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
2. Three-phase motor and appliance branch circuits.
3. Flexible raceway runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance.

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. Hangers and supports for electrical equipment and systems.
      2. Construction requirements for concrete bases.

   B. Related Requirements:
      1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation
         requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include construction details, material descriptions, dimensions of individual components
         and profiles, and finishes for the following:
         a. Hangers.
         b. Steel slotted support systems.
         c. Nonmetallic support systems.
         d. Trapeze hangers.
         e. Clamps.
         f. Turnbuckles.
         g. Sockets.
         h. Eye nuts.
         i. Saddles.
         j. Brackets.
      2. Include rated capacities and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS
   A. Seismic Qualification Certificates: For hangers and supports for electrical equipment and
      systems, accessories, and components, from manufacturer.
      1. Basis for Certification: Indicate whether withstand certification is based on actual test of
         assembled components or on calculation.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to local codes.
   1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Component Importance Factor: [1.5] [1.0].

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit; a part of Atkore International.
      b. B-line, an Eaton business.
      c. ERICO International Corporation.
      d. Flex-Strut Inc.
      e. GS Metals Corp.
      f. G-Strut.
      g. Haydon Corporation.
      h. Metal Ties Innovation.
      i. Thomas & Betts Corporation, A Member of the ABB Group.
      j. Unistrut; Part of Atkore International.
      k. Wesanco, Inc.

   3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
   6. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in
riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

      1) Hilti, Inc.
      2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

      1) B-line, an Eaton business.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti, Inc.
      4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.


2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.
PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or
greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. **To Steel:** Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.

7. **To Light Steel:** Sheet metal screws.

8. **Items Mounted on Hollow Walls and Nonstructural Building Surfaces:** Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. **Field Welding:** Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified.

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

A. **Touchup:** Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
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. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Nonmetal wireways and auxiliary gutters.
   5. Surface raceways.
   7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
   1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
   2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

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

1. AFC Cable Systems; a part of Atkore International.
2. Allied Tube & Conduit; a part of Atkore International.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. FSR Inc.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.
7. Patriot Aluminum Products, LLC.
8. Picoma Industries, Inc.
10. Robroy Industries.
12. Thomas & Betts Corporation, A Member of the ABB Group.
13. Western Tube and Conduit Corporation.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:
   a. Material: Steel.
   b. Type: Setscrew or compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems; a part of Atkore International.
   2. Anamet Electrical, Inc.
   3. Arnco Corporation.
   4. CANTEX INC.
   5. CertainTeed Corporation.
   7. Electri-Flex Company.
   8. Kraloy.
   10. Niedax Inc.
   11. RACO; Hubbell.
   12. Thomas & Betts Corporation, A Member of the ABB Group.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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

1. B-line, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.

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

   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. MonoSystems, Inc.
   c. Panduit Corp.
   d. Wiremold / Legrand.

2.5 BOXES, ENCLOSURES, AND CABINETS

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

1. Adalet.
3. EGS/Appleton Electric.
5. FSR Inc.
6. Hoffman; a brand of Pentair Equipment Protection.
8. Kraloy.
10. MonoSystems, Inc.
11. Oldcastle Enclosure Solutions.
13. RACO; Hubbell.
15. Spring City Electrical Manufacturing Company.
17. Thomas & Betts Corporation, A Member of the ABB Group.
18. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:
   1. Material: Cast metal or sheet metal.
   2. Type: Semi-adjustable.
   3. Shape: Rectangular.
   4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
   1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

I. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
   1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
L. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

M. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

N. Gangable boxes are allowed.

O. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

P. Cabinets:
   1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:
   1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
   2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armorcast Products Company.
      b. Carson Industries LLC.
      c. NewBasis.
      d. Oldcastle Precast, Inc.
      e. Quazite: Hubbell Power Systems, Inc.
      f. Synertech Moulded Products.
   2. Standard: Comply with SCTE 77.
   3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of hot-dip galvanized-steel diamond plate.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. NewBasis.
   d. Nordic Fiberglass, Inc.
   e. Oldcastle Precast, Inc.
   g. Synertech Moulded Products.

2. Standard: Comply with SCTE 77.
4. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC.".
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: GRC, IMC or EMT.
3. Underground Conduit: RNC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC or IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
   4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION
   A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
   B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
   C. Complete raceway installation before starting conductor installation.
D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Owner for each specific location.
   5. Change from ENT to GRC or IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Where otherwise required by NFPA 70.

V. Comply with manufacturer’s written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:
   1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
   2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
      c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
      d. Attics: 135 deg F temperature change.
   3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer’s written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
   2. Install backfill as specified in Section 312000 "Earth Moving."
   3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.

7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDBOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
3.6  FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7  PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS


B. Comply with NFPA 70.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.

B. Raceways and Cables Carrying Circuits at More Than 600 V:
   1. Black letters on an orange field.
   2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning labels and signs shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Champion America.
      c. emedco.
      d. Grafoplast Wire Markers.
      e. LEM Products Inc.
      f. Marking Services, Inc.
      g. Panduit Corp.
      h. Seton Identification Products.

B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Marking Services, Inc.
   c. Panduit Corp.
   d. Seton Identification Products.

C. Self-Adhesive Labels:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A'n D Cable Products.
   b. Brady Corporation.
   c. Brother International Corporation.
   d. emedco.
   e. Grafoplast Wire Markers.
   f. Ideal Industries, Inc.
   g. LEM Products Inc.
   h. Marking Services, Inc.
   i. Panduit Corp.
   j. Seton Identification Products.

2. Preprinted, 3-mil-thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.
   a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable diameter, such that the clear shield overlaps the entire printed legend.

3. Polyester or Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
   a. Nominal Size: 3.5-by-5-inch.

4. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

5. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 BANDS AND TUBES:

A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
b. Marking Services, Inc.
c. Panduit Corp.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they identify. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Panduit Corp.

2.5 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlton Industries, LP.
   b. Champion America.
   c. Ideal Industries, Inc.
   d. Marking Services, Inc.
   e. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Carlton Industries, LP.
   c. emedco.
   d. Marking Services, Inc.

C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. LEM Products Inc.
   b. Marking Services, Inc.
   c. Seton Identification Products.

D. Underground-Line Warning Tape
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Ideal Industries, Inc.
   c. LEM Products Inc.
   d. Marking Services, Inc.
   e. Reef Industries, Inc.
   f. Seton Identification Products.

2. Tape:
   a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   b. Printing on tape shall be permanent and shall not be damaged by burial operations.
   c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:
   b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
   c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 Tags
A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Carlton Industries, LP.
   c. emedco.
   d. Marking Services, Inc.
   e. Seton Identification Products.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Grafoplast Wire Markers.
e. LEM Products Inc.
f. Marking Services, Inc.
g. Panduit Corp.
h. Seton Identification Products.

C. Write-On Tags:

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

   a. Carlton Industries, LP.
   b. LEM Products Inc.
   c. Seton Identification Products.

2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.
3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
4. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 Signs

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Carlton Industries, LP.
   b. Champion America.
   c. emedco.
   d. Marking Services, Inc.

B. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

   a. For signs up to 20 sq. inches, minimum 1/16-inch.
   b. For signs larger than 20 sq. inches, 1/8 inch thick.
   c. Engraved legend with white letters on a dark grey background.
   d. Punched or drilled for mechanical fasteners.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

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

   a. Brady Corporation.
   b. Carlton Industries, LP.
   c. emedco.
   d. Marking Services, Inc.

2.8 CABLE TIES

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

   1. Ideal Industries, Inc.
   2. Marking Services, Inc.
   3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

   2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

   2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

   2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.
   5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer’s wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

J. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
K. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

3.3 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "UPS."

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.


1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for direct-buried cables and cables in raceways.

F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
      a. Power-transfer switches.
      b. Controls with external control power connections.
      c. Service disconnect switches.

   2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.

I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
      b. Outdoor Equipment: Engraved, laminated acrylic.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
   
   b. Enclosures and electrical cabinets.
   
   c. Access doors and panels for concealed electrical items.
   
   d. Switchgear.
   
   e. Switchboards.
   
   f. Transformers: Label that includes tag designation shown on Drawings for the transformer.
   
   g. Emergency system boxes and enclosures.
   
   h. Enclosed switches.
   
   i. Enclosed circuit breakers.
   
   j. Enclosed controllers.
   
   k. Power-transfer equipment.
   
   l. Contactors.
   
   m. Remote-controlled switches, dimmer modules, and control devices.
   
   n. Power-generating units.
   
   o. Monitoring and control equipment.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:
   1. Indoor occupancy sensors
   2. Indoor photo sensors

B. This Section includes the following daylighting control devices:
   1. Dimmed control of electronic dimming ballasts with photo sensor, occupancy sensor and wall box dimmer.

C. Related Sections include the following:
   1. Section 26 05 19 Copper Conductors and Cables

1.2 DEFINITIONS

A. LED: Light-Emitting Diode.

B. PIR: Passive Infrared.

C. PDT: Passive Dual Technology.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 26 05 00 - Common Work Results For Electrical.

B. Product Data: Provide clearly marked and legible data sheets for each item of equipment being installed on the project. This shall include each major replaceable component that is part of a larger assembly. Data sheets should clearly indicate:
   1. Equipment manufacturer, make, model number, size, nameplate data, etc.
   2. Dimensional and performance data for specific unit provided as appropriate
   3. Required environmental operating parameters
   4. UL, FM and ETL listing and category
   5. Manufacturer contact information including address, telephone number, facsimile number, email address, web site address and contact person or persons.
   6. Local manufacturer’s representative contact information including address, telephone number, facsimile number, email address, web site address and contact person or persons.

C. Label List: Submit list of proposed text for all labels prior to manufacturing for review and approval by Owner’s representative.

D. Warranty: Submit a copy of product warranty that complies with contract document requirements. Where these requirements exceed manufacturer’s standard warranty include cost of extended warranty in contract price.
E. Maintenance Requirements: Submit maintenance requirements manual or guidelines. This document should detail the requirements necessary to comply with the warranty. This is required for the submittal process and is in addition to the O&M requirements.

F. Commissioning Checklist: Submit a copy of the proposed commissioning checklist to be utilized for this project.

G. Commissioning Results: Submit a copy of the completed commissioning documents.

1.4 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate with system manufacturer to provide equipment which will most effectively control lighting within designated spaces. Contractor and equipment manufacturer are responsible for providing equipment which takes into consideration the size and occupant use of the space, and any other limiting factors in the field to properly control these areas.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer shall have been in the business of manufacturing and providing service for lighting control equipment for similar capabilities and size, under the same name and ownership, for a minimum of three years preceding bid date of the project

2. All components and assemblies shall be factory pre-tested prior to installation.

3. Factory trained technicians shall be on site for start-up, commissioning and training

4. Factory trained technicians shall be available for telephone support twenty four (24) hours a day, seven (7) days a week

B. Regulatory Requirements


1.6 WARRANTY

A. Manufacturer’s Warranty: The manufacturer shall provide a written warranty agreeing to provide parts to replace any portion of the lighting control system equipment that fails due to material or workmanship for a period of twelve months from warranty commencement.

B. Warranty Commencement: Warranty shall begin at the point of substantial completion of the system installation, which is defined as the date when commissioning and owner training has been completed and the owner obtains beneficial use of the system.

C. Warranty Replacement Parts: The manufacturer shall be able to ship replacement parts within 24 hours for any component that that fails due to material or workmanship during the warranty period.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the contract documents, and functional integration with the existing lighting control system currently in operation at the site, provide products from one of the following manufacturers:

1. Douglas Lighting Controls
2. Watt Stopper / Legrand

2.2 INDOOR OCCUPANCY SENSORS

A. General Operation

1. The Occupancy Sensor system shall sense the presence of human activity within the desired space and fully control the on/off function of the loads automatically, set to MANUAL ON, AUTO OFF for vacancy sensing. Sensors shall turn on the load within 2 feet of entrance and shall not initiate "on" outside of entrance.
2. Sensing technologies shall be completely passive in nature, in that the occupancy sensor system shall not emit or interfere with any other electronic device, or human characteristic. Acceptable known technologies are Passive Infrared (PIR), or Microphonic.
3. Upon detection of human activity by the detector, a Time Delay shall be initiated to maintain the light on for a field adjustable pre-set period.
4. Mounting
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2 inch knockout in a standard electrical enclosure.
   c. Time Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Automatic Photo Sensor: Adjustable from 2 to 200 footcandles to turn lighting off when selected light level is present.
6. Line Voltage Sensors
   a. Sensor shall be a self-contained dual voltage device capable of directly switching loads upon detection of human activity.
   b. Sensor must be rated for 800 watts at 120 VAC, suitable for incandescent light fixtures, fluorescent light fixtures with magnetic or electronic ballasts, or 1/6 hp motors or rated for 1000 watts at 277 VAC, suitable for fluorescent light fixtures with magnetic or electronic ballasts, or 1/3 hp motors minimum. Sensor shall be capable of parallel wiring for 3-way switching applications.
   c. Sensor Time Delay shall be factory set for typical applications, and field adjustable from 30 seconds to 20 minutes. Sensor must provide a green LED motion indicator.
7. Low Voltage Sensor
   a. Sensors must be designed to work in conjunction with remote power packs, relays, or other control systems. Sensors must operate with a Class 2, low voltage wiring
strategy. Sensors must be capable of being parallel wired for multi-sensor applications.

b. Sensor must provide a transistor output, returning the voltage input rectified to DC, to control remote power packs, relays, or other control systems. Sensor must have optional single pole, double throw signal relay capable of being wired open on occupancy, or closed on occupancy. Sensor Time Delay shall be factory set for typical applications, and field adjusted during commissioning.

8. System components shall be selected to provide full coverage of the intended area in the manner intended. This design should use any variety of sensors to accomplish this task, and shall be designed based on field conditions present at the time of installation.

B. Switch-Box Occupancy Sensors

1. General

   a. Photo sensor override shall be factory set in the off mode, but be field adjustable. All adjustments shall be concealed once installed.

   b. Sensor must not protrude out from the cover plate more than 0.37 inches, and recess into the switch box more than 1 inch. Sensor must surface mount to single gang switch box, and accept accessory plates for multi-gang installations. Sensor must provide a vertical sliding Off/Auto override switch, (2 switches if 2-pole device).

   c. Optional 2-Pole units shall be available. Additional photo sensor override of either pole shall also be available. Power switching shall be performed with a mechanical relay in parallel with an AC Semiconductor to allow relay contacts to switch under a no load condition.

   d. Where conditions exceed maximum allowable distances, areas, or other field conditions require additional control in the space, such control will be designed and installed as needed.

2. Passive Infrared (PIR) Technology

   a. PIR sensing, incorporating a combination of heat and movement sensing to detect occupancy in the area of coverage.

3. Passive Dual Technology (PDT)

   a. Sensing must incorporate PIR with Micro phonics, which utilizes a passive microphone with automatic gain control (AGC) to sense both occupants moving and sounds. The PIR must be used to initiate an ON condition; once ON the PIR or Micro phonics shall keep the load on. After the time delay expires and the load goes off, the Micro phonics shall remain active up to 10 seconds as a back-up grace period.

   b. PDT sensors shall be provided unless specific site conditions prohibit the use of any devices utilizing Micro phonics which could interfere with equipment in the space.

4. Small Area Wall Switch Sensors
a. Small Area Wall Switch Sensors must be provided for small spaces where the occupant's work area is within 20 feet of sensor and the space is no larger than 300 square feet.
b. PIR sensing, incorporating a nominal one half inch focal length Fresnel lens, designed to view at least 9 inches above and 9 inches below the horizontal plane when measured 10 feet from the sensor. The PIR beam pattern must be at least 170 degrees with 20 separate beams evenly spaced.

C. Ceiling Occupancy Sensors

1. General
   a. Sensor shall be circular ceiling mounted device, mounted to a single gang enclosure.
   b. Time delay shall be set during commissioning and field adjustable.
   c. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
   d. Bypass Switch: Override the "on" function in case of sensor failure.
   e. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s). Detection Coverage
      1) Small Room: Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
      2) Standard Room: Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
      3) Large Room: Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
      4) Corridor: Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

2. Passive Infrared (PIR) Technology
   a. PIR sensing, incorporating a combination of heat and movement sensing to detect occupancy in the area of coverage.
   b. PIR sensing must utilize a high density Fresnel domed lens, providing a circular view pattern of 360 degrees.
   c. Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in.

3. Dual Technology (DT)
   a. Sensing must incorporate PIR with Ultrasonic. Both PIR and Ultrasonic motion sensing shall initiate an ON condition and either technology sending motion shall keep the ON state.

D. Wall Mount Occupancy Sensors (low voltage)

1. General
   a. Sensor shall be designed for large spaces where the occupants work area is up to 40 feet from the sensor. Sensor shall be mounted 8 to 10 feet above the floor, out
of occupants reach. Sensor shall be mounted either flat against the wall or in a corner. For pendant mount fixture applications, sensor shall be mounted below the level of the fixture.

b. Sensor time delay shall be set during commissioning and shall be capable of being field modified if necessary.

c. Sensors shall be capable of parallel wiring for multi-sensor applications.

2.3 POWER PACKS AND SLAVE PACKS

A. Power Packs and Slave Packs must be designed to power and accept signals from remote Low Voltage Sensors, or other control devices, and directly switch the line voltage of the desired load controlled.

B. Power Packs shall accept 120, 240, or 277 VAC utilizing a dual tap transformer.

C. Power Pack and Slave Pack relay switching shall not require more than 3 milliamps of current at 15 to 30 VDC.

D. Power Pack and Slave Pack relay switching shall be performed with a mechanical relay in parallel with an AC Semiconductor to allow relay contacts to switch under a no load condition. Switching capacity shall be 20 amps of all types of loads: Incandescent, Electronic Ballast, Magnetic, or Motor.

E. Power Packs shall be available in combination 2-Pole units capable of switching two independent loads, 20 amps each.

2.4 PHOTO SENSORS

A. The photo sensor shall interface with multi-input digital addressable dimming ballasts. Dimming sensor shall connect directly to the ballast or module with 4 low voltage wires. Photo sensing element shall be a photoelectric sensor. Sensors shall be closed loop for single zone control or open loop for multi-zone control.

2.5 DAYLIGHT ZONE DIMMING CONTROL WITH LOCAL DIMMING

A. The lighting fixtures in this room configuration shall be controlled by manual wall dimmers, occupancy sensors and photo sensors. The wall dimmers and occupancy sensor together shall control all normal power lighting circuits in the room. The light photo sensor shall automatically dim the lamps located in the daylight zone (as indicated on the contract drawings) in response to available daylight.

B. Wall dimmers:

1. As specified in section 26 27 26 Wiring Devices.

C. Dimming Ballast:

1. Standard 4-wire, 0-10 VDC dimming ballast as specified in Section 26 50 00 - Lighting, quantity as required to control each fixture in the daylight zone as specified in Section 26 50 01 Lighting Fixture Schedule.

D. Occupancy sensor:
1. Occupancy sensor shall be a ceiling-mounted device, powered by the DC voltage supplied by a remote power pack or other control device which is directly connected to the load.

2. Provide quantity of power pack and slave packs with control relays as required to control all designated circuits in the daylighting area.

E. Photo Sensor:

1. Photo sensor shall be a low voltage device, directly connected to the 0-10V control loop of the dimming ballast.

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Section 26 05 19 – Copper Conductors and Cables.

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 22 AWG, complying with Section 26 05 19 - Copper Conductors and Cables.

C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Section 26 05 19 - Copper Conductors and Cables.

D. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Section 26 05 19 - Copper Conductors and Cables.

E. Cabling which is not installed in conduit or raceway shall be plenum rated.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Install sensors in accordance with manufacturer's instructions. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 26 05 19 - Copper Conductors and Cables.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 05 53 - Identification For Electrical Systems.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify actuation of each sensor and adjust time delays.

B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 SYSTEM STARTUP AND COMMISSIONING

A. Commissioning shall take place prior to demonstration of system to Owner. After the system has been installed the Contractor shall provide manufacturer’s recommended commissioning with factory trained and authorized technicians on-site, to:

1. Verify that the contractor has properly installed and interconnected all necessary components.
2. Verify correct operation of all system components.
3. Verify that all switch and contact inputs are in compliance with contract requirements.
4. Occupancy sensors and photo-sensors: Ensure that each sensor is correctly placed and oriented to provide the intended function. Adjust sensor location if unanticipated obstructions are present that impede the proper operation of the device.
5. Occupancy Sensors: Adjust sensitivity and time delay of the occupancy sensor and test to ensure it provides appropriate response. Set initial time delay for 15 minutes. Set to MANUAL ON, AUTO OFF for vacancy sensing.
6. Dual Technology Type Occupancy Sensors: If interferences occur, disable either PIR or ultrasonic technology as appropriate for application.
7. Daylight harvesting: Calibrate sensors after all furnishings and interior finishes are installed. Adjust photo-sensor to determine the threshold for switching based upon the detected light level. Calibrate sensor under normal daylight levels and dusk light levels.
8. Daylight dimming controls: Confirm that lamps are pre-seasoned by manufacture or season lamps as recommended by manufacture prior to dimming.
9. Submit completed verification checklist.

3.6 OWNER’S INSTRUCTIONS AND SYSTEM DEMONSTRATION

A. System Demonstration

1. Schedule demonstration a minimum of two-weeks prior to system turn over and substantial completion. Schedule with owner’s representative and electrical engineer.
2. Demonstrate complete system operation and contract compliance to designated owner’s representative and engineer to prove system is functional and ready for comprehensive training.

B. System Instruction

1. The Contractor shall after one week (minimum) written notification to Owner conduct an instruction session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner. The session shall be conducted by a Contractor’s representative thoroughly familiar with the characteristics of the system. O & M manual information regarding the system shall be turned over to the Owner prior to scheduling the instruction session.

2. Training shall utilize the following draft documents:
   b. Contractor’s record drawings

3. The training effort shall validate the O&M Manual and record drawing documentation.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.

B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.

2. Manuals:
   a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the contractor that the wiring devices conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. National Fire Protection Association (NFPA):
   70-11 .................................. National Electrical Code (NEC)
   99-12 .................................. Health Care Facilities

C. National Electrical Manufacturers Association (NEMA):
   WD 1-10 .............................. General Color Requirements for Wiring Devices
   WD 6-08 .............................. Wiring Devices – Dimensional Specifications

D. Underwriter’s Laboratories, Inc. (UL):
   5-11 ..................................... Surface Metal Raceways and Fittings
   20-10 ..................................... General-Use Snap Switches
   231-07 ................................. Power Outlets
   467-07 ................................. Grounding and Bonding Equipment
   498-07 ................................. Attachment Plugs and Receptacles
   943-11 ................................. Ground-Fault Circuit-Interrupters
   1449-07 .............................. Surge Protective Devices
   1472-96 .............................. Solid State Dimming Controls

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
   1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
   2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.
B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.

1. Bodies shall be ivory in color.
2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The lower receptacle shall be unswitched.
3. Duplex Receptacles on Emergency Circuit:
   a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.

4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring.
   a. Ground fault interrupter shall be consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
   b. Ground Fault Interrupter Duplex Receptacles (not hospital-grade) shall be the same as ground fault interrupter hospital-grade receptacles except for the hospital-grade listing.

5. Safety Type Duplex Receptacles:
   a. Bodies shall be gray in color.
      1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.
      2) Screws exposed while the wall plates are in place shall be the tamperproof type.

6. Duplex Receptacles (not hospital grade): Shall be the same as hospital grade duplex receptacles except for the hospital grade listing and as follows.
   a. Bodies shall be brown nylon.

C. Receptacles; 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.
2.2 TOGGLE SWITCHES

A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.

1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self-grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.

2. Switches shall be rated 20 amperes at 120-277 Volts AC.

2.3 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.

B. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

C. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.

D. Duplex Receptacles on Emergency Circuit: Wall plates shall be type 302 stainless steel, with the word “EMERGENCY” engraved in 6 mm (1/4 inch) red letters.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown as on the drawings.

B. Install wiring devices after wall construction and painting is complete.

C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.

D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.

1. Provide barriers in multigang outlet boxes to comply with the NEC.

E. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.

F. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
G. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.

H. Install wall dimmers 1.2 M (48 inches) above floor.

I. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.

J. Install vertically mounted receptacles with the ground pin up. Install horizontally mounted receptacles with the ground pin to the right.

K. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.

L. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer’s required field checks in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:
   a. Inspect physical and electrical condition.
   c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
   d. Test GFCI receptacles.

2. Healthcare Occupancy Tests:
   a. Test hospital grade receptacles for retention force per NFPA 99.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.
B. NO: Normally open.
C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Fuse Pullers: Two for each size and type.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency’s Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
   2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
   2. Indicate method of providing temporary electric service.
   3. Do not proceed with interruption of electric service without Owner’s written permission.
   4. Comply with NFPA 70E.
1.11 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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

1. ABB Inc.
2. Eaton.
4. Siemens Industry, Inc.
5. Square D; by Schneider Electric.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

2.2 SHUNT TRIP SWITCHES

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

1. Bussmann, an Eaton business.
2. Littelfuse, Inc.
3. Mersen USA.

B. General Requirements: Comply with UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

E. Accessories:
   1. Oiltight key switch for key-to-test function.
   2. Oiltight green ON pilot light.
   3. Isolated neutral lug; 100 percent rating.
   4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
   5. Form C alarm contacts that change state when switch is tripped.
   6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
   7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Eaton.
   2. General Electric Company.
   4. Square D; by Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.


D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.
   4. Ground-fault pickup level, time delay, and I²t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
G. Integranlly Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interruption (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Zone-Selective Interlocking: Integral with electronic ground-fault trip unit; for interlocking ground-fault protection function.
11. Electrical Operator: Provide remote control for on, off, and reset operations.
12. Accessory Control Power Voltage: Integranlly mounted, self-powered; 24-V ac or 120-V ac.

2.4 MOLDED-CASE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
2. General Electric Company.
4. Square D; by Schneider Electric.

B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Features and Accessories:
1. Standard frame sizes and number of poles.
2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
3. **Ground-Fault Protection:** Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

4. **Shunt Trip:** Trip coil energized from separate circuit, with coil-clearing contact.

5. **Undervoltage Trip:** Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

6. **Auxiliary Contacts:** One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.

7. **Alarm Switch:** One NO contact that operates only when switch has tripped.

8. **Key Interlock Kit:** Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.

9. **Zone-Selective Interlocking:** Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.

10. **Electrical Operator:** Provide remote control for on, off, and reset operations.

11. **Accessory Control Power Voltage:** Integrally mounted, self-powered; 120-V ac.

### 2.5 ENCLOSURES

**A. Enclosed Switches and Circuit Breakers:** NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. **Indoor, Dry and Clean Locations:** NEMA 250, Type 1.
2. **Outdoor Locations:** NEMA 250, Type 3R.
3. **Kitchen Areas:** NEMA 250, Type 4X, stainless steel.
4. **Other Wet or Damp, Indoor Locations:** NEMA 250, Type 4.
5. **Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids:** NEMA 250, Type 12.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

**A.** Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

#### 3.2 INSTALLATION

**A.** Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

**B.** Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

**C.** Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This section provides general requirements for a complete and fully operational lighting system including:

1. Interior lighting fixtures
2. Exit signs
3. Accessories
4. Light fixture support

1.2 RELATED SECTIONS:

A. Section 26 09 23 - Lighting Control Devices
B. Section 26 05 26 - Grounding and Bonding for Electrical Systems

1.3 REFERENCES

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and Sections under Division 1 General Requirements.

B. Conform to Reference Standards by date of issue current on date of Contract Documents, except where a specific date is established by code.

1. Light Fixture Datasheets and catalog numbers indicated are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of lamp, ballast, finish trim, ceiling type, mounting hardware, or special requirements as specified or as required by the particular installations. Provide complete fixture to correspond with the features, accessories, number of lamps, wattage and/or size specified in the text description of each fixture type. Additional features, accessories and options specified shall also be included.

B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed fixtures shall have frames that are compatible with the ceiling systems.

C. Light fixture voltage shall match the voltage of the circuit serving the light fixture.
1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers’ laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

C. 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.

D. Comply with NFPA 70.

E. FMG Compliance: lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

F. Luminaires, ballasts, lamps and other components and controls shall equal or exceed the requirements of all applicable state and/or municipal energy codes.

G. Designated manufacturers are listed to define the requirements for quality and function of the specified product. Equivalent or better products of other, unnamed manufacturers may be proposed for consideration by adhering to procedures set forth in this section and in Specification Section 00 16 00 – Product Requirements.

1.6 SUBMITTALS

A. Comply with requirements of specification section describing Submittal Procedures

B. The authorized manufacturer’s representative for the project area shall prepare submittals for each lighting fixture type. In addition to the fixture submittals, a list shall be provided identifying the manufacturer representative for each fixture type. Provide manufacturers’ names, addresses, and telephone numbers. Requests for prior approval shall also include this information. Submittals or requests for prior approval without this information will be rejected.

C. Product Data shall indicate that light fixture, lamps, and ballasts fully comply with contract documents. Data shall be submitted for each type of light fixture indicated, arranged in order of fixture designation. For standard catalog fixtures provide original product catalog sheets indicating data on features, accessories, finishes, and the following:

1. Materials and dimensions of luminaires.
2. Photometric data, in IESNA format, based on certified results of laboratory tests of each light fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the light fixture as applied in the Project.

   a. Photometric data shall be certified by a qualified independent testing agency.
   b. Photometric data shall be certified by a manufacturer’s laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
3. LED power supplies.
4. Types of lamps, including manufacturer, wattage, and Color Rendering Index (CRI) and color temperature in degrees Kelvin (K).

D. Wiring Diagrams shall detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

E. Product Certificates shall be signed by manufacturers of lighting fixtures certifying that products comply with requirements.

F. Dimming Ballast Compatibility Certificates shall be signed by the manufacturer of ballast certifying that ballasts are compatible with dimming systems and equipment with which they are used. Product certificates signed by the product manufacturer shall be provided for each type of ballast for bi-level and dimmer controlled fixtures.

G. Maintenance Data shall be provided for lighting fixtures and equipment to include in emergency, operation, and maintenance manuals specified in specifications section describing Operations and Maintenance Data.

H. Field quality control test reports.

I. Special Warranties specified in this Section.

J. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition, or quantities. Contractor shall field verify voltage and actual mounting condition and method.

1.7 SUBSTITUTIONS

A. Comply with requirements of specification section describing Product Requirements.

B. Lighting fixtures are based on the fixture types and manufacturers specified. If substitution of fixtures other than those specified is desired, product information must be submitted to the Lighting Designer 10-days prior to the close of the bid period. No requests for substitution will be accepted after this date.

C. Substitution requests shall include all information required under in paragraph 1.6 - SUBMITTALS. Requests for approval shall be accompanied by a working fixture sample (including lamps, cord and plug). Provide the name of at least one installation where each proposed substitute has been installed for at least six months. Provide the name and telephone number of the Owner, Owners' Representative, and Lighting Designer of record.

D. Equipment delivery lead time shall not be held as a valid reason for requesting luminaire substitution unless luminaire lead time from specified manufacturer is in excess of 14 weeks. It shall be the sole responsibility of the Contractor to determine necessary equipment lead times, deliver submittals for review in a timely fashion, and place orders accordingly to ensure timely delivery.

E. When requesting a substitution, Contractor shall provide unit and extended pricing for specified luminaire, unit and extended pricing for proposed alternate, and unit and extended savings to Owner to be realized by accepting proposed alternate. If requested, Contractor shall provide unit pricing for each luminaire type specified to provide a baseline comparison for substitution request.
F. If required by the Lighting Designer, the proposed substitutions must be installed at the bidder’s expense in a location selected by the Owner or Lighting Designer.

G. If the substitution request is accepted, approval will be in the form of an addendum to the specifications issued to all registered plan holders.

H. A maximum of two substitution requests shall be reviewed for any single fixture type. If a substitution has not been approved following this process, the Contractor shall provide the specified fixture.

1.8 CUSTOM LIGHT FIXTURES

A. All custom light fixtures require a prototype to be submitted prior to commencement of fabrication. The purpose of the prototype will be to review construction, lamp placement within the fixture, lamp type, optical assembly, finishes, etc. Modifications may be required as a result of the prototype review. These modifications and others that do not materially affect the cost of the fixture shall be incorporated at no additional cost to the Owner.

1.9 COORDINATION

A. Coordinate layout and installation of light fixtures with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, AV, and partition assemblies.

B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed fixtures shall have frames that are compatible with the ceiling systems.

C. Coordination Meetings: Meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type. During second meeting, coordinate fixture layout in each area. Meet at least twice with the mechanical systems installer prior to fabrication and installation of ductwork. Coordinate depth and location of all light fixtures and ductwork in all areas.

1.10 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranties for Fluorescent Ballasts: Written warranty to furnish to UWMC fluorescent ballasts that fail in materials or workmanship within specified warranty period.

1. Special Warranty Period for Electronic Ballasts: three years from date of Substantial Completion.

2. Special Warranty Period for Electromagnetic Ballasts: One year from date of Substantial Completion.

C. Special Warranty for Fluorescent Lamps: to furnish to UWMC lamps that fail in materials or workmanship, within
1. Two years from date of Substantial Completion.

D. Special Warranty for LED Lighting Fixtures: A warranty for luminaires, covering repair or replacement of defective electrical parts (including light source and power supplies) within specified warranty period indicated below.

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

E. Exit Signs Utilizing LED Lamp Technology: Provide manufacturer’s warranty including parts and labor for full replacement of defective product within specified warranty period indicated below:

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Catalog series numbers specified in Section 26 50 01 represent the type and style of fixture. The fixture size shall correspond with the wattage indicated in Section 26 50 01 – Lighting Fixture Schedule (Datasheets) or the actual length of the fixture as indicated on the drawings.

B. Numbers are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of lamp, type of ballast, finish trim, ceiling type, mounting hardware or special requirements as specified as required by the particular installations. Acceptable manufacturers and series numbers are listed. The manufacturer listed shall provide complete fixtures equaling or exceeding the written specifications. Verify these requirements and order fixtures as required for a complete and fully operational installation per the contract documents and per code.

2.2 GENERAL MATERIAL REQUIREMENTS

A. Fixtures shall be free of light leaks while providing sufficient ventilation of lamps to provide the required photometric performance. Ballasts and transformers shall be adequately vented.

B. Lampholders shall hold lamps securely against normal vibration and maintenance handling.

C. Light fixtures containing lamps which require protective shielding shall be furnished with a tempered glass lens or approved unbreakable lens UL listed for the application.

D. Metal Parts shall be free from burrs, sharp corners, and edges. Metal work shall be free from tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.

E. Sheet Metal Components shall be steel, unless otherwise indicated. Components shall be formed and supported to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.
F. Fixture hardware to comply with the following material standards: For steel and aluminum fixtures, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel fixtures, all hardware shall be stainless steel. For bronze fixtures, all hardware shall be stainless steel or bronze.

G. Doors, Frames, and other internal access shall be smooth operating, free from light leaks under normal operating conditions, and designed to permit relamping without use of tools.

H. Provide supplemental safety device or arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with fixture performance, maintenance, or the seating of any fixture element. Safety device shall not be visible during normal fixture operation and from normal viewing angles.

I. For all luminaires, provide a ballast disconnection means in accordance with NEC 410.130(G).

J. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 %.
2. Specular Surfaces: 90 %.
3. Diffusing Specular Surfaces: 75 %.
4. Laminated Silver Metallized Film: 90 %.

K. Reflector cones shall adhere to the following criteria:

1. Cones designed for vertically mounted lamps shall provide a minimum of 45 degree cutoff of lamp and lamp image. Cones designed for horizontally mounted lamps shall provide a minimum of 55 degree cutoff of lamp and lamp image. There shall be no visible lamp flashing in the cone.
2. Plastic material shall not be used for reflector cones, unless otherwise specified.
3. Cones shall not be permanently fastened to the housing or ceiling and shall be removable without tools. Retention devices shall not deform the cone or be visible from normal viewing angles.
4. Trim shall be flush to the finished ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the reflector cone.
5. Reflector cones shall be of uniform gauge, not less than 0.032" thick, high purity aluminum Alcoa 3002 alloy. Cones shall be free of spin marks or other defects.
6. Manufacture cone using the Alzak process. Refer to the fixture schedule for cone color and finish (i.e. specular or diffuse) requirements. For compact fluorescent fixtures, finish shall eliminate iridescence.

L. Lenses, Diffusers, Covers, and Globes shall be 100 % virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic, polycarbonate and acrylic shall be UV stabilized and shall have high resistance to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation.
2. Lens Thickness shall be 0.125" (3 mm) unless other thickness is indicated.
3. Lenses shall have uniform brightness throughout the entire visible area.

M. Adjustable light fixtures shall have positive locking devices to fix the aiming angle. Fixtures shall be capable of being relamped without adjusting the aiming angle.
N. Each lighting fixture that has a lamp with an oval shape beam pattern or a spread lens that defines beam orientation shall contain lamp or lens locking devices to insure that lamp or lens orientation is not disturbed during future lamp replacement or cleaning.

O. All fixtures and ballasts must operate within the temperature limits of their design and as specified by Underwriters' Laboratories, Inc. in the applications and mounting conditions herein specified.

P. Fixtures recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform with NEC Article 300-22.

Q. Provide plaster frame for recessed light fixtures mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering light fixtures.

R. Provide wire guards on all fluorescent open strip type fixtures.

S. For weatherproof or vaportight installations, painted finishes of fixtures and accessories shall be weather resistant enamel using proper primers or galvanized and bonderized epoxy, so that the entire assembly is completely corrosion resistant for the service intended. Exterior finishes shall have an outdoor life expectancy of not less than 20 years without any visible rust or corrosion. Where aluminum parts come into contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.

T. Fixtures for use outdoors or in areas designated as damp locations shall be suitably gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation openings. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.

U. Welding shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth. All welds on or behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling, depressions or other forms of distortion or discoloration. Remove weld spatter and welding oxides from all welded surfaces.

V. Electromagnetic-Interference Filters shall be factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate light fixtures with one filter on each ballast indicated to require a filter.

2.3 LED FIXTURES

A. All Luminaires

1. Comply with IES LM79 and IES LM80 LED product testing procedures, and DOH Energy Star requirements.

2. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable fixtures with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

3. Color spatial uniformity shall be within .004 of CIE 1976 diagram.

4. Color maintenance over rated life shall be within .007 of CIE 1976.

5. Indoor luminaires shall have a minimum CRI of 75.
6. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.
7. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver at least 70% of initial lumens, when installed in-situ, for a minimum of 35,000 hours.

B. Power Supplies and Drivers

1. Power Factor: 0.90 or higher
2. Operating temperature: minimum of -20°C or below when used in luminaires intended for outdoor use.
3. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
4. Output operating frequency: ≥ 60Hz.
6. Total Harmonic Distortion Rating: Less than 20%.
7. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
8. Primary Current: Confirm primary current with Electrical Drawings.
10. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
11. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

C. Controller and Control System

1. System electronics driver / controller to use 0-10V
2. Contractor to ensure that external control equipment is compatible with LED control requirements
3. Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.
4. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers.

2.4 WIRING

A. All wiring shall be as required by code for fixture wiring.

B. All flexible cord wiring between fixture components or to electrical receptacles and not in wireways shall have a minimum temperature rating of 105 degrees Celsius.

C. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.

D. No internal wiring shall be visible at normal viewing angles.

E. Provide #18 AWG, 3 wire flexible conduit connections (whips) for dual level switching as shown on Electrical Drawings for light fixtures recessed in accessible suspended ceiling. Provide 3-wire whips for all dual level switching. Wire count on wire whips is not shown on
Drawings and shall be the responsibility of the Contractor to provide proper wire count for the lighting control as shown on Drawings.

2.5 FIXTURE SUPPORT COMPONENTS

A. Comply with Section pertaining to General Electrical Provisions, paragraph entitled Equipment anchorage, Support, Seismic Restraint, and Bracing for fixture support and bracing.

B. Where the ceiling is of insufficient strength to support the weight of the lighting fixtures, provide additional framing from building structure to support luminaires as required. Do not support fixtures from ceiling T-Bar system.

C. Single-Stem Hangers shall be 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish shall be the same as the luminaire.

D. Twin-Stem Hangers shall be two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish shall be the same as the luminaire.

E. Rod Hangers shall be 3/16-inch minimum diameter, cadmium-plated threaded steel rod.

F. Wires shall be ASTM A 641/A 641M, Class 3, soft temper, zinc coated steel, 12 gauge.

G. Wires for humid spaces shall be ASTM A 580/A 580M, composition 302 or 304, annealed stainless steel, 12 gauge.

H. Hook Hangers shall be integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

I. Aircraft Cable Support shall use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

J. Hangers for Pendant Industrial Fixtures shall be heavy duty No. 8 jack chain with hangers, “S” hooks, mounting straps, and all required accessories for complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer’s written instructions and approved submittal materials. Install lamps in each fixture.

B. Mounting height indicated in drawings from finished floor to bottom of pendant light fixture or to the center of the outlet box for wall mounted light fixtures unless otherwise noted. Verify mounting heights with Owner and Lighting Designer.

C. Mounting height may also be indicated as the length of the pendant below finished ceiling.

D. Provide all necessary hanging or mounting devices and accessories for all fixtures. Verify the types needed for various ceiling conditions. Plaster rings shall be provided where required.
E. Verify weight and mounting method of all fixtures prior to ordering and provide suitable support. Coordinate with General Contractor for fixtures that require additional blocking or support. Fixture mounting assemblies shall comply with all local seismic codes and regulations.

F. Refer to architectural reflected ceiling plans for coordination of light fixture locations with mechanical and fire safety equipment. Where conflicts occur, coordinate with Owner and Lighting Designer prior to installing any of the systems.

G. In accessible suspended ceilings, fixture wiring connection, including equipment grounding conductor, is to be through use of 72-inch flexible conduit from a rigidly supported junction box.

H. Wire per requirements of branch circuit installation. Properly ground each fixture.

I. Light fixtures located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box equal to that of the ceiling.

J. Install fixtures with vent holes free of air blocking obstacles.

K. Contractor shall be responsible for adjusting aperture flanges or rings on all recessed fixtures to be flush with the finished ceiling. Fixture trim shall completely conceal ceiling opening.

L. Adjust variable position lampholders for proper lamp position prior to fixture installation.

3.2 FIXTURE SUPPORT

A. Comply with specifications section describing General Electrical Provisions, paragraph entitled Equipment Anchorage, Support, Seismic Restraint, and Bracing for fixture support and bracing.

B. Provide all necessary hanging or mounting devices for all fixtures, verify the type needed for various ceiling conditions. Plaster rings shall be provided where required.

C. Ceiling Fixture Support: Where ceiling is of insufficient strength to support weight of light fixtures installed, provide additional framing from building structure to support as required.

D. Provide two slack No. 9 safety wire hangers or threaded rods for each recessed mounted fluorescent fixture. Secure from opposite corners of each fixture and fasten to structure above, independent of ceiling system. Locate supports not more than 6 inches from fixture corners.

E. Electrical Contractor is to provide and install locking clips for all fixtures installed in suspended ceilings. The locking clip is to be attached to the fixture with a sheet metal screw or similar device and secured to the main or supporting T-bar runner to guarantee a secure installation. Clips shall be located at or near fixture corners.

F. Fixtures which are of a size smaller than the ceiling grid shall be located as indicated on the reflected ceiling plans. Fixtures shall be supported independently of the grid ceiling with at least two ¾ inch metal channels spanning and secured to the ceiling tees.

G. Metal decking shall not be pierced for luminaire support.
H. Where pendants or rods are longer than 48 inches, brace to limit luminaire swinging.

I. Brace suspended luminaires installed near ducts or other elements so that they do not swing into obstructions.

J. Wall mounted light fixtures shall be supported from four-square outlet box plaster ring and from wall at non-feed end with two 1/4-inch toggle bolts for gypsum board walls or 1/4-inch bolts to pre-set inserts for concrete wall.

3.3 LED FIXTURES

A. Adhere to manufacturers installation guidelines regarding proper thermal management.

3.4 LIGHTING CONTROL

A. Provide branch circuiting in coordination with lighting control requirements of specification section describing Lighting Control Equipment and as indicated on Electrical Drawings.

3.5 CLEANING AND ADJUSTING

A. Remove protective plastic covers from light fixtures and fixture diffusers only after construction work, painting and clean-up are completed. Remove, clean, and reinstall all dirty lamps, reflectors and diffusers.

B. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors and other surfaces.

C. Make final adjustment of aimable light fixtures and adjustable light settings under the direction of the Lighting Designer during a scheduled period of time prior to the completion of the project, after normal business hours if required. Include all equipment and personnel expenses including overtime required for focusing.

D. Fixtures, reflectors, and accessories which are damaged, blemished, or impregnated with fingerprints shall be replaced at the contractor's expense. All finishes shall be unmarred upon project completion.

3.6 FIELD QUALITY CONTROL

A. Coordinate all testing procedures and schedule with the specification section describing Commissioning Agent – Demonstration and Training. All testing is to be documented with test procedures, results and initials of witnessing personnel and submitted to Commissioning Agent.

B. Coordinate inspection and testing of Lighting Fixtures with specification section describing – Lighting Control Equipment.

C. Inspect each installed fixture for damage. Replace damaged fixtures and components.

D. Replace all burned out lamps or inoperative lamps at the end of construction prior to Owner occupancy.

E. Advance Notice: Give dates and times for field tests.
F. Provide instruments to make and record test results.

G. Test as follows:

1. Verify proper operation, switching and phasing of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation. Verify normal transfer to generator and retransfer to normal.
3. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to the lighting system, retest to demonstrate compliance with standards.

H. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

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. Metal conduits and fittings.
   2. Nonmetallic conduits and fittings.
   3. Optical-fiber-cable pathways and fittings.
   4. Metal wireways and auxiliary gutters.
   5. Surface pathways.
   7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
   1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
   2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

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

1. AFC Cable Systems; a part of Atkore International.
2. Allied Tube & Conduit; a part of Atkore International.
3. Alpha Wire.
4. Anamet Electrical, Inc.
5. Electri-Flex Company.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.
7. Picoma Industries, Inc.
8. Republic Conduit.
9. Robroy Industries.
10. Southwire Company.
11. Thomas & Betts Corporation, A Member of the ABB Group.
12. Western Tube and Conduit Corporation.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit IMC.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel or die cast.
   b. Type: Setscrew or compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
G. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

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

1. AFC Cable Systems; a part of Atkore International.
2. Allied Tube & Conduit; a part of Atkore International.
3. Anamet Electrical, Inc.
4. CANTEX INC.
5. Carlon; a brand of Thomas & Betts Corporation.
6. CertainTeed Corporation.
8. Dura-Line.
10. Kraloy.
11. Niedax Inc.
12. RACO; Hubbell.
13. Thomas & Betts Corporation, A Member of the ABB Group.

B. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Rigid HDPE: Comply with UL 651A.

E. Continuous HDPE: Comply with UL 651B.

F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

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

1. Alpha Wire.
2. Carlon; a brand of Thomas & Betts Corporation.
3. Dura-Line.
4. Endot Industries Inc.
5. IPEX USA LLC.

B. Description: Comply with UL 2024; flexible-type pathway, approved for general-use installation unless otherwise indicated.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. B-line, an Eaton business.
   2. Hoffman; a brand of Pentair Equipment Protection.
   3. MonoSystems, Inc.
   4. Square D; by Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4 or Type 12 unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer’s standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Allied Moulded Products, Inc.
   2. Carlon; a brand of Thomas & Betts Corporation.
   3. Hoffman; a brand of Pentair Equipment Protection.
   4. Niedax Inc.

B. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Owner from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlon; a brand of Thomas & Betts Corporation.
   b. MonoSystems, Inc.
   c. Panduit Corp.
   e. Wiremold / Legrand.

2.7 BOXES, ENCLOSURES, AND CABINETS

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

1. Adalet.
2. Carlon; a brand of Thomas & Betts Corporation.
4. EGS/Appleton Electric.
5. Erickson Electrical Equipment Company.
6. FSR Inc.
7. Hoffman; a brand of Pentair Equipment Protection.
8. Milbank Manufacturing Co.
9. Molex Industrial Products Group; Woodhead Brand.
10. MonoSystems, Inc.
11. Oldcastle Enclosure Solutions.
14. RACO; Hubbell.
15. Robroy Industries.
16. Spring City Electrical Manufacturing Company.
17. Stahlin Non-Metallic Enclosures.
18. Thomas & Betts Corporation, A Member of the ABB Group.
19. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy aluminum, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

K. Gangable boxes are allowed.

L. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R or Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type 1 or Type 3R, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. NewBasis.
   d. Oldcastle Precast, Inc.
   e. Quazite: Hubbell Power Systems, Inc.
   f. Synertech Moulded Products.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open, closed or integral closed bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "COMMUNICATIONS."
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC, RNC, Type EPC-40-PVC.
2. Concealed Conduit, Aboveground: GRC, RNC, Type EPC-40-PVC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Damp or Wet Locations: GRC.
5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, communications-cable pathway.
6. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, communications-cable pathway.
7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: General-use, communications-cable pathway.
8. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 3/4-inch trade size. Minimum size for optical-fiber cables is 1 inch.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.

2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.

3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.

4. Do not embed threadless fittings in concrete unless specifically approved by Owner for each specific location.

5. Change from ENT to RNC, Type EPC-40-PVC, before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for pathways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer’s written instructions.

L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

R. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer’s written instructions. Tape and glue are not acceptable support methods.

S. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

T. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

U. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service pathway enters a building or structure.

3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

W. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.
3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 “Earth Moving” for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 “Earth Moving.”
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 “Earth Moving.”
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 “Identification for Electrical Systems.”

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 ACRONYMS, TERMS, AND DEFINITIONS USED IN THESE SPECIFICATIONS

A. UW = University of Washington
B. SFD = City of Seattle Fire Department
C. AHJ = Authority Having Jurisdiction
D. Construction Coordinator = University's Representative
E. Owner = University of Washington
F. Vendor = The local authorized representative of the manufacturer to sell, install and service the fire alarm system
G. Local = The main office and service center are located within 50 miles of the job site.
H. Installer = The installer of conduit, wire and equipment
I. Emergency = A failure of the installed system which, in the reasonable opinion of the UW or AHJ, creates an unsafe or intolerable condition requiring immediate correction
J. Shop Drawings = The drawings created by the Contractor (Installer and Vendor) utilizing AUTOCAD, submitted for approval and then used and modified by the Installer and Vendor during construction
K. As-Built Drawings = A single set of shop drawings which shall be updated daily during construction (See 1.10)
L. Record Drawings = To include all of the information shown on the as-built drawings. This information shall be added to AUTOCAD Architectural backgrounds. (See Section C-2, 4.01 Documents.)
M. FACP = A Fire Alarm Control Panel which processes alarm information and controls outputs
N. FCC-E = Fire Command Center – East which is located in existing room SA1007A1
O. VESDA = Very Early Smoke-Detection Apparatus.

1.2 SCOPE OF WORK

A. Work included: This specification establishes the requirements for the design and installation or modifications and extensions of the existing fire detection and alerting system at the
University of Washington Medical Center as described in this specification and the referenced drawings. The fire alarm scope of work is the relocation of a fire alarm system and VESDA equipment for a pre-action system that includes but is not limited to the following:

1. Designing and provision of a complete fire detection and alerting system
2. All necessary conduit and wiring associated with the fire detection and alerting system
3. Smoke detectors
4. VESDA design, piping layout and associated calculations
5. Speakers, strobes and remote lamps

1.3 CODES AND STANDARDS

A. Perform all work in accordance with the requirements of the latest issue of the following codes and standards, unless specifically directed otherwise in this specification in order to allow designs in excess of the code requirements.

1. International Fire Code with local amendments (including SFD Administrative Rulings)
2. International Building Code with local amendments (including DPD Director's Rules)
3. NFPA 72 - National Fire Alarm Code (NFPA 72)
4. WAC - (Washington Administrative Code) 296-46
5. NEC - National Electric Code (NFPA 70)
6. Safety Code for Elevators and Escalators (ANSI A17.1) as amended by DPD Director's Rule 21-97 (Revised)
7. Americans with Disabilities Act (ADA)
9. Local rules and interpretations required by the authority having jurisdiction, including Seattle Building and Fire Codes.

1.4 APPROVAL AUTHORITIES

A. The approval authority for this section of the project shall be the University of Washington Fire Protection Engineer and the Seattle Fire Department. If there is a conflict in requirements, the University of Washington Fire Protection Engineer has final authority for approvals.

1.5 FIRE ALARM VENDOR QUALIFICATIONS

A. The fire alarm system shall be installed by skilled electricians and mechanics, all of whom are properly trained and qualified for this work. As a minimum, the system must conform to all codes and manufacturer's recommendations.

B. The vendor shall design, supervise, program, test, and commission the installed system and provide warranty service. The vendor design shall complement the design provided by the A/E.

C. The vendor shall be the manufacturer or a local authorized representative of the manufacturer with a proven track record of being responsive, providing accurate and complete submittals, meeting project schedules, and being prepared for system testing and acceptance.
D. The vendor must be able to provide any replacement part on site within 48 hours during the warranty period.

E. The vendor shall be able to provide a fully equipped and qualified factory-trained repair technician at the job site within 4 hours of request for emergency services. This service shall be available 24 hours a day during the term of warranty.

F. The vendor shall have successfully completed similar local (Western Washington) jobs in scope and nature, using the proposed product line, fire alarm panel and equipment, in other buildings over the past three years. For new product lines, one system shall have been completed and in service for at least 18 months.

G. The vendor shall have sufficient means and capacity to provide the required submittals on schedule including, but not limited to, CAD equipment and qualified technicians.

H. The vendor shall employ factory-trained personnel to program, test, and commission the system.

I. The vendor shall be UL certified for Vendor Alarm Service (UUJS).

J. Installers shall have certification (FA-1) from the Seattle Fire Department in accordance with SFC Appendix III-B.

1.6 SITE CONDITIONS

A. The Contractor is advised that the drawings are diagrammatic in nature and are not intended to show all details.

B. The Contractor is expected to provide all miscellaneous parts and labor required to install a complete workable system.

C. The Contractor shall coordinate with the University's Construction Coordinator to define areas where the installer can store tools, equipment and other materials for this project.

D. The area is to be kept clean and neat at all times. Construction debris shall be removed daily.

E. The Contractor will be responsible for the security of all items stored in this area.

1.7 FIRE WATCH AND FIRE PROTECTION SYSTEM SHUTDOWNS

A. A continuous fire watch is required anytime the fire alarm system is impaired, including impairments and outages that affect any area of the building, including non-hospital spaces (e.g. Group B occupancies such as offices, labs, etc.). The Contractor shall provide a continuous approved fire watch in accordance with Seattle Fire Department Administrative Rule 9.06.04. The fire watch shall include but is not limited to the following:

1. Fire watch shall be performed by licensed security personnel, trained in the use and operation of portable fire extinguishers and instructed in how to contact the UW Police dispatcher by either radio or telephone.

2. Continuous rounds to cover all areas of the building are required every 30 minutes.
3. An evacuation plan which includes a method to notify all occupants is required in occupied buildings.
4. Maintain a log of the rounds and comprehensive notes.
5. Provide a 30-day notice to the Owner and attend coordination meetings for fire watch approval.

B. Provide 14 days written notification to the University's Construction Coordinator, requesting approval for fire protection system shutdown or functional impairment; receipt of the approval from the University's Construction Coordinator is required before any system shutdown or functional impairment.

1.8 SUBMITTALS

A. Conform to Section 01 33 00, Shop Drawings, Product Data, Samples, and UW Drawing Standards.


C. Submit the following in accordance with the conditions of Contract and Division 1 Specification Sections:

1. Prepare and submit 6 copies of shop drawings and catalog cut sheets and additional information required in this section, via the Construction Coordinator, to the A/E, UW Fire Protection Engineer and Fire Alarm Shop for Owner approval.
2. Upon receipt of A/E and Owner approval, shop drawings shall then be forwarded to the SFD for their approval.
3. One copy of Owner-approved shop drawings with SFD approval, and accompanying letter, shall then be submitted to the University's Construction Coordinator. Partial submittals are unacceptable.
4. The Vendor shall not start any construction nor order any materials prior to acceptance of all submittals by the Owner and the SFD.
5. Submittals, as a minimum, shall include the following:

   a. Floor plans drawn with AUTOCAD to same scale as the architectural drawings, showing device layout, raceway routing, riser diagrams, conduit and wire size, wire identification numbers, room and floor identification numbers. These drawings shall be produced as follows:

      1) The Owner shall forward a copy of the Architectural backgrounds to the Contractor.
      2) The Contractor's drawings will show all equipment locations and all wiring requirements, utilizing the UW wiring standards in Table 3.06.B and UW symbols as illustrated on the plans.
      3) With this information and drawings, the Contractor will create a raceway, conduit and riser design meeting the requirements in section 3.06.
      4) The Contractor must then ensure completeness, including wire information, room numbers, devices, equipment and all other pertinent information.
6. Typical point-to-point wiring diagrams of the control panels, including but not limited to, all control and annunciator panel components, field devices, relays, fans, elevators, and other auxiliary control(s), and terminal cabinets showing all installed wiring (not factory wiring harnesses) and wiring connections. All variances from typical shall be illustrated in separate diagrams.

7. Label all components. Identify circuits using identification labels listed in Table 3.06B.

8. Detailed mounting installation diagrams of the control panel(s), remote annunciator(s), and keyed signal silencing switch.

9. Battery calculations, speaker, and strobe circuit voltage drop and power consumption

10. Riser diagrams with FACP, terminal cabinets, raceway layout, circuit identification labels per 3.06, riser conduit size, and all devices; horizontal and vertical lines shall be provided to illustrate floors and zones.

11. Show air-sampling detector pipe routing.


13. Front view of the control panel(s) and all annunciator panels.

14. FACP, labels and labeling schemes for circuits, and field devices; nameplates and messages on the control panel(s) and annunciators shall be provided in actual size.

15. Wire/circuit legend with circuit identification, color, gauge, wire type, number of conductors, etc.

16. Raceway size calculations showing % fill in accordance with this specification (see Section 3.06)

17. Circuit schedules for speakers, strobes, auxiliary controls, and software/advisory code zones.


19. A Materials Submittal cover sheet identifying all FACP equipment, model number, and quantities.

D. Within 45 days after Owner approval of shop drawings and catalog cut sheets, submit the following for review and approval via the construction coordinator to the UW Fire Protection Engineer and the UWMC Fire Alarm Shop for Owner approval:

1. A written acceptance test procedure (see Section 4.02)

2. A complete fire alarm device point list for all circuits to identify the following:

   a. Device address (initiating only)
   b. Manufacturer fixed labels (device type)
   c. Custom labels (conforming to UW standard format)
   d. Software zone (same as annunciation alarm LED)
   e. This list shall also include signaling and all other auxiliary circuits.
   f. Prepare this list on Microsoft Excel using 8½” x 11” or larger sheets.

1.9 AS-BUILT DRAWINGS

A. While the system installation is in progress, one set of shop drawings will be kept at the job site.

1. This set will be designated as the As-Built Drawings and will be updated regularly to reflect current as-built information.

2. One set of as-built drawings can be replaced with a fresh updated set of drawings, but there shall never be more than one active set of as-built drawings.
3. The UW shall be given access to this set of as-built drawings at all times so that progress maybe reviewed and copies maybe made.
4. At the end of the project, submit these marked-up as-built drawings as part of the as-built drawings (see section 4.01).

1.10 FIRE ALARM SYSTEM DESCRIPTION

A. Equipment and materials shall include the following:
   1. Equipment and circuits for the following:
      a. Alarm initiating devices
      b. Evacuation notification devices
      c. Fire alarm system monitored, controlled, and powered equipment

1.11 SYSTEM OPERATION DESCRIPTION

A. Fire alarm functions: Activation of a pull station, sprinkler water flow or activation of an automatic sensing device for fire, temperature, flame, or smoke shall result in the following:
   1. An audible evacuation alarm signal will continuously sound a "chime" signal until the system is reset, silenced, or the voice override is utilized.
   2. The visual evacuation alarm devices will flash rapidly until the system is reset.

B. Auxiliary control functions: The fire alarm system shall, during certain alarm conditions, control the following types of equipment: Doors, fans, dampers, elevators, etc. Direct control from detector output contacts is not permissible unless the contacts are fully programmable from the FACP. As a minimum, the controls shall accomplish the following:
   1. Automatically restore the signal to the controlled systems to normal operation after FACP is reset from alarm posture
   2. Drop all magnetically-held doors following a 10-second time delay.
   3. Release exit stair doors and other electrically secured doors at a switch located in FCC-East.
   4. Magnetically held doors shall not share the same circuit as electrically secured door switches.

1.12 INTERFACE WITH EXISTING FIRE ALARM SYSTEM*

A. The existing fire alarm system shall not be disabled at any time without appropriate coordination with the Owner and fire watch provisions.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new. Previously used equipment is not acceptable unless specifically identified elsewhere in this specification.
2.2 MANUFACTURER

A. The fire alarm control equipment shall consist of a system assembled as an approved unit of regularly manufactured components, by a single manufacturer for the purposes described elsewhere in this specification. The fire alarm control equipment must have a proven track record of service and reliability in projects of similar scope to this project. Interconnecting equipment that has not been listed for interconnection, or the creation of components or system into a nonstandard unit that is not normally available from the manufacturer, is not acceptable.

B. All equipment shall be listed, cross-listed, and labeled by Underwriters' Laboratories and approved by Factory Mutual.

C. Providing they meet all specifications, control panels and related equipment shall be manufactured by JCI/SimplexGrinnell, with no exceptions, and no substitutions.

2.3 VOICE COMMUNICATION SYSTEM

A. Audio amplifiers shall be sized to provide ½ Watt minimum per attached audio speaker as shown on the drawings. Each audio amplifier shall have 50% minimum spare capacity when attached to the speakers necessary to meet audio requirements.

B. FACP shall incorporate a spare automatic backup audio amplifier equal in size to the largest individual amplifier.

2.4 SMOKE DETECTORS/SENSORS

A. Ceiling or area-type smoke detectors

1. Detectors shall be photoelectric addressable analog with separate base.
2. The detectors, complete with terminating equipment, shall be fully supervised and shall not activate alarm due to rapid changes in humidity, or a fan maintenance shutdown, etc.
3. The detector shall be equipped with LED alarm condition indicator light.
4. When exposed back boxes are needed, use round "wire mold" boxes of the appropriate size.

2.5 ADDRESSABLE INTERFACE MODULE

A. Provide addressable interface modules to interface with non-addressable initiating devices, i.e. water flow, tamper switches, kitchen, and fume hood suppression systems. Field control modules are not allowed.

2.6 AIR-SAMPLING SMOKE DETECTOR

A. General Description:

1. Air-sampling smoke detector is existing, relocated.
2. Utilize established VESDA system parameters, communications and programming.
3. Pipe airflow balancing calculations shall be performed using approved calculation software.

B. Detector:

1. Power Supply:
   a. Regulated 24-V dc, monitored by the fire-alarm control unit, with battery backup.

C. Sampling Tubes:

1. Smooth bore with a nominal 1-inch OD and a 7/8-inch ID. Sampling pipe with between 5/8- and 1-inch ID can be used in specifically approved locations when recommended by manufacturer.
3. Joints in the sampling pipe shall be airtight. Use solvent cement approved by the pipe manufacturer on all joints except at entry to the detector.
4. Identify piping with labels reading: "Aspirating Smoke Detector Pipe - Do Not Paint or Disturb" along its entire length at regular intervals according to NFPA 72.
5. Support pipes at not more than 60-inch centers.
6. Fit end of each trunk or branch pipe with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.
7. If using multiple pipe runs, the runs shall be pneumatically balanced.

D. Sampling Holes:

1. Sampling holes of 5/64 inch, or other sized holes per manufacturer's written instructions, shall be separated by not more than the maximum distance allowable for conventional smoke detectors. Intervals may vary according to calculations.
2. Follow manufacturer's written recommendations to determine the number and spacing of sampling points and the distance from sampling points to ceiling or roof structure and to forced ventilation systems.
3. Each sampling point shall be identified by an applied decal.

2.7 AUDIBLE ALARM DEVICES

A. Speaker/strobes shall be red, have sealed back, metal grill, with multiple wattage taps including ¼, ½, 1 watt, and 2 watts, and multiple candela taps including 15, 30, 75, or 110. Indoor speaker/strobes shall be Wheelock E70-24 MCW-FR or approved substitution.

B. Install all speakers at the ½-watt setting unless indicated otherwise on the drawings. Speakers located in rest rooms and similar enclosed areas where alarm threshold maybe high should be tapped at ¼ watt.

C. Speakers shall be flush mounted.

1. Where necessary, surface mounting red Wheelock SBB box shall be used.
2. For flush mounting use a 4S deep j-box with an extension ring or the 5S j-box by Randl Industries (note: 5S box allows installations in walls not deep enough to accommodate the 4S box and extension ring).
D. Outdoor and environmental rooms with high humidity and controlled temperature, including coolers and freezers:
   1. Speaker/Strobe: Wheelock ET-70WP-2475-FR speaker with Wheelock 10B-R back box or approved substitution.
   2. Provide weatherproof back box with weep hole oriented down, and seal conduit penetration with mastic.

E. An open circuit in any speaker or horn coil shall not prevent the rest of the audio devices connected to that circuit from operating.
   1. If a short circuit occurs, the faulted circuit shall not prevent any other circuit from operating, and trouble shall be indicated.
   2. If the shorted circuit clears, signaling operation shall be automatically restored.

F. The speaker cable shield or drain wire shall remain intact and be spliced through all terminal cabinets, junction boxes and speakers.
   1. The drain wire shall not be grounded for terminated except at the main FACP.
   2. Wherever the drain wire is exposed, it shall be wrapped with UL approved electrical tape, in order to avoid shorts or grounds.

2.8 STROBES (VISUAL ALARM)

A. Visual alarm signal shall operate at 24 volts DC and be equipped with a Xenon strobe flashing light which meets requirements outlined in 2.14 above.
   1. Use Wheelock series RSS-24MCW-FR.
   2. Use Wheelock series RSSWP-2475W strobe with Wheelock WPSBB-R back box for outdoor and environmental rooms.
   3. Flashers shall be combined into one unit with speakers (or horns) where appropriate.

B. All strobe circuits to be synchronized.

2.9 SPARES

A. Provide FACP spare equipment for 5% (at least two each) spare fully operational speaker, strobe and auxiliary control circuits.

B. Provide 20% spare capacity for FACP I/O points and mapnet.

C. FACP Auxiliary relays, minimum 3 amp. form "C" contacts.

D. FACP Control/Bypass switches - (insert value)
PART 3 - INSTALLATION

3.1 APPROVAL

A. No equipment shall be provided at the job site until shop drawings have been reviewed and approved by the UW and AHJ. A UW and AHJ approved shop drawing set shall be continuously available at the job site during construction.

3.2 MOUNTING POSITION

A. FACP: Locate as shown on the drawings.

B. VESDA: Locate as shown on drawings.

C. Speaker/Strobe(s): Locate as shown on drawings.

3.3 MOUNTING METHODS

A. Conduit, panels, devices and boxes shall be secured by means of expansion shields in concrete, machine screws on metal surfaces, and wood screws on wood construction. Attachment with devices driven in by power charge or nail type nylon anchors is not acceptable in lieu of machine screws.

3.4 WIRING

A. General wiring and raceway system. Raceway installation shall be field reviewed by the owner prior to pulling wire.

1. The manufacturer's recommendations shall only be used as a minimum requirement.

2. All wire shall be new, UL approved and marked and brought to the job site in original packages.

3. Wire insulation shall be one of the types required by NEC. All wires shall be sized per NEC for the load serviced. Field wiring for initiation, supervision and signal circuits shall be solid conductor. All wire shall be approved for fire alarm installations.

4. "Pig tailing" and Tee tapping is prohibited for all system circuits, except door circuits and addressable signaling line circuits.

   a. Addressable signaling line circuits may be Tee tapped only in the terminal can for the floor which that circuit serves.

5. Fire alarm system shall be wired "Class B", device to device, with no splicing unless approved by the Owner.

6. End of line resistors shall be located in the terminal cabinet or the end of the corridor or other unassigned (public) space for the zone served.

7. Splicing shall be made with Minnesota Mining & Mfg. Co. "Scotchloc" spring connectors with steel cap and PVC insulation, Thomas & Betts or approved equal.

8. Colors shall match when possible and the conductors shall be mechanically secured to each other so that no stress is applied to the splice.

9. Aluminum wire and stranded wire are both prohibited.

10. Wire pulls by powered mechanical means will not be permitted.
a. Conduit shall be thoroughly cleaned of all foreign material just prior to pulling the wire or cable.
b. Lubricants shall be compounds specifically prepared for cable pulling and shall not contain petroleum or other products which will affect cable insulation.

11. Wire that has scrapes, nicks, gouges, or crushed insulation shall not be used and must be removed.
12. All wiring on circuits being modified or demolished shall be removed back to the last operational device.
13. Do not run low voltage energy limited wiring in the same wire-ways with, or closely parallel to, high voltage and/or switched power wiring.
14. Interposing relays shall be used for all switched power loads and shall be located such that the switched power conductors do not run in the same raceway as the interposing relay coil power or any other energy-limited low voltage conductors.
15. All wiring shall be contained in metal conduit or raceways dedicated to fire alarm service.
16. Conduit size shall be 1/2 inch minimum. Wire mold shall be #700 minimum (also see Section 16A06, Basic Electrical Requirements).
17. No raceway shall be filled in excess of 40%. The Contractor shall demonstrate by performing fill calculations showing that the designs comply with these criteria. Exceptions are only allowed when use of existing wire ways is approved.
18. The raceway system shall resemble a branch and tree configuration. Branches shall be provided with sufficient junction boxes so that not more than three unassociated circuits pass through a device back box. Follow manufacturer’s instruction for wires in device back boxes (e.g., Wheelock does not allow (used for other than the signaling appliance) through the back box).
19. Metal Clad (MC) cable is allowed where use of EMT conduit is not feasible in difficult retrofit applications with specific approval of the owner. The cable must also be approved by the fire alarm system manufacturer.
20. All raceways shall run parallel or perpendicular to walls, floors, and ceilings.
21. For surface-mounted raceway, runs shall be routed on walls out of visual sight, with vertical drops to wall-mounted devices. Submit routing proposal to A/E for approval prior to installation.
22. Do not encase raceway in concrete unless specifically called for.
23. No wire run or circuit shall be longer than 80% of the maximum allowable length and power consumption for the wire size and application. No output circuit shall exceed 80% of the maximum load capacity specified by the manufacturer.
24. Terminate all wiring for each zone or floor in a terminal cabinet as indicated on the contract drawings prior to running the wires to the fire alarm panel. Provide at least one terminal cabinet for each floor.
25. All solid wire terminations shall be made bare to screw terminals specifically designed for bare wire connection. Make cable shield terminations with T&B "Sta-Kon" (or equivalent) self-insulated spade lugs where connected to screw type terminals.
26. Wiring in all cabinets and terminal boxes shall be neatly arranged and bundled with tie wraps or equivalent.
27. Paint all junction box covers for the fire alarm system red. Paint J-Box covers in finished areas to match the wall or ceiling and put a ½-inch minimum red dot on the cover.
28. All conduit and raceways shall be color-coded by a ¾-inch red tape band at 10-foot intervals. Use Scotch Brand #35 tape or approved equal.
29. All inductive loads (door holders, interface relays) without integral reverse EMF suppression must have suppression on those circuits.
B. The following wire will be used unless an alternate is approved by the Owner. Color-coding shall be by wire insulation. Single conductor wires shall be solid.

### TABLE 3.06.B
**Wire and Cable Requirements**

<table>
<thead>
<tr>
<th>Circuit Type</th>
<th>Quantity/Color</th>
<th>Size</th>
<th>Section</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addressable circuit</td>
<td>West Penn D975, or</td>
<td>#18</td>
<td>0.0450 sq.in.</td>
<td>L</td>
</tr>
<tr>
<td>(Note 1)</td>
<td>Belden 5320FJ</td>
<td>#18</td>
<td>0.035 sq.in.</td>
<td>L</td>
</tr>
<tr>
<td>24 VDC</td>
<td>1 pink (pos.) THHN#14</td>
<td>#18</td>
<td>0.0174 sq.in.</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>1 grey (neg)THHN</td>
<td>#18</td>
<td>0.0174 sq.in.</td>
<td>P</td>
</tr>
<tr>
<td>Remote Test Switch</td>
<td>1 pair TFN (2 pink)</td>
<td>#16</td>
<td>0.0158 sq.in.</td>
<td>R</td>
</tr>
<tr>
<td>Remote Indicator Light</td>
<td>1 white TFN &amp;</td>
<td>#16</td>
<td>0.0158 sq.in.</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>1 blue TFN</td>
<td>#16</td>
<td>0.0158 sq.in.</td>
<td>R</td>
</tr>
<tr>
<td>Monitor Switch (tamper, flow &amp; pressure)</td>
<td>2 pair TFN (2 yellow, 2 brown)</td>
<td>#16</td>
<td>0.0158 sq.in.</td>
<td>T</td>
</tr>
<tr>
<td>Audio Alarm (speakers)</td>
<td>Belden 5220FL</td>
<td>#16</td>
<td>0.0249 sq.in.</td>
<td>A</td>
</tr>
<tr>
<td>(Note 1,2)</td>
<td>Belden 5120FL</td>
<td>#14</td>
<td>0.037 sq.in.</td>
<td>D</td>
</tr>
<tr>
<td>Visual Alarm (strobos)</td>
<td>1 pair THHN</td>
<td>#14</td>
<td>0.0174 sq.in.</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>1 brown (negative)</td>
<td>#14</td>
<td>0.0174 sq.in.</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>1 blue (positive)</td>
<td>#14</td>
<td>0.0174 sq.in.</td>
<td>V</td>
</tr>
<tr>
<td>(Note 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door Holder &amp; Door Lock</td>
<td>1 black, 1 red THNN</td>
<td>#14</td>
<td>0.0174 sq.in.</td>
<td>D</td>
</tr>
<tr>
<td>Smoke Control Damper</td>
<td>1 pair THHN (light blue)</td>
<td>#14</td>
<td>0.0174 sq.in.</td>
<td>Z</td>
</tr>
<tr>
<td>Fan Control (simple shutdown)</td>
<td>2 orange THHN</td>
<td>#14</td>
<td>0.0174 sq.in.</td>
<td>H</td>
</tr>
<tr>
<td>Fan Control (shutdown, overide, and status)</td>
<td>5 orange THHN (3 orange, control) (2 orange, status)</td>
<td>#14</td>
<td>0.0435 sq. in.</td>
<td>Q</td>
</tr>
</tbody>
</table>
Fireman's Phone  Belden 5320FL or Connect-Air W181P-1608  #18  0.0189 sq.in.  F
(Note 1)

Elevator Recall
4 yellow THHN  #14  0.0348 sq.in.  E
Panel Ground  1 green THHN  #10  0.0184 sq.in.  -
Panel Power See Division 26 Section 26 05 19  #12  0.0234 sq.in.  -

NOTE 1: Cable must conform to FACP system manufacturer's requirements.

NOTE 2: Contractor's option, 14 or 16 gauge (see 2.04.) This is a two conductor shielded cable. The same size cable shall be used for the entire system.

NOTE 3: See 2.05. All circuits shall be 14 gauge; twelve-gauge wire is prohibited. Provide multiple circuits for a single zone as required.

Fire Alarm Circuit Integrity (CI) Cable, 2-hour fire rated per UL 1724 shall be provided for the wiring serving the fire alarm riser and the wiring serving the stair and elevator pressurization fans.

C. All circuits and conduits shall be identified in accordance with Table 3.06C, with labels to include circuit type, zone, floor, wing, and conduit number. Labels must be provided at the FACP, annunciator, terminal cabinets, and all junction boxes with more than 5 circuits. Labels shall be produced using an electronic labeler.

TABLE 3.06.C
Wire Labeling

Format: X XX XX XX XX
ID Z F W C

Example:  V 12 6 J 26

Circuit (ID) = Per Wire Table (i.e.. V for Visual)
Zone (Z) = 1, 2, 3,........, 23, 24
Floor (F) = M1, 01, 02,........, 10, 11
Wing (W) = A, B, C,........, NN, EA, SW
Conduit (C) = 01, 02, 03,........, 10, 11, 12

D. All initiating and signaling circuit devices shall be externally labeled with a printed adhesive label approximately ½” x 1” in size. Identify the circuit and zone, consistent with wire labeling scheme, using a 12 to 14 point font, black ink on white.
PART 4 - FINAL ACCEPTANCE REQUIREMENTS

4.1 RECORD DOCUMENTS

A. As a condition for the project final acceptance, the vendor shall submit the following documents to the UW for approval:

1. Operation and Maintenance Manuals: See Section 00 17 00
   a. Submit a copy of the O&M Manual to the UW Signal Shop
   b. The O&M Manual shall include as-built drawings as listed below catalog cuts, and manufacturer wiring diagrams of all FACP components. Photocopies are not acceptable.

2. As-built drawings:
   a. The as-built drawings shall be neatly prepared on AUTOCAD Release 12 (or higher).
   b. The UW will provide use of a standard template, a library of symbols, colors and layers and one day of support and instruction in the UW protocols.
   c. Provide 2 sets of prints, one set of fixed line reproducible (size 24” x 36” or 36” x 42”) and 2 sets of AutoCAD disks. These drawings shall include the following:
      1) All requirements listed for shop drawings per 1.09
      2) Changes as a result of final installation, testing, or a change to the system design
      3) An accurate depiction of risers, raceway, conduit, all wire runs, cable identification, conduit size, location of junction boxes, terminal boxes, sources of power, devices, sensors, equipment, controlled equipment (motor starters, fans, pumps, valves, dampers, etc.)

4.2 TESTING

A. The completed system shall be subjected to 2 required tests.

B. The initial test shall be a preliminary test which will be conducted by the Contractor and commissioned by the UW Fire Protection Engineer, the UW Fire Alarm Shop and the A/E.

   1. This test shall be completed after the system is complete and clear of troubles.
   2. Should the results not be satisfactory to the Owner's representatives, then corrections will be made and a re-test will be required at the Contractor's expense. The Installer and a factory trained technician for the FACP shall be present for all testing.
   3. The preliminary test shall be in accordance with a written Acceptance Test Procedure (ATP) to demonstrate and certify proper system operation.

      a. The ATP shall be prepared by the Contractor and submitted to the Owner for approval prior to the performance of the ATP.
      b. As a minimum, the ATP shall provide a detailed method of testing and documenting the following to demonstrate to the Owner that the system functions as intended by the design.
c. The document shall be a written test procedure and customized check-off sheets for the following as a minimum:

1) All detectors shall be removed from their base and checked for trouble. Remove one device per addressable circuit from its box and lift a wire to test for supervision and ground. Failure due to improper system wiring will require a comprehensive test of the circuit.

2) Remove one device per signaling circuit from its box and lift a wire to test for supervision and ground. Failure due to improper system wiring will require a comprehensive test of the circuit.

3) All bypass and control switches shall be operated to indicate proper supervision of the switch.

4) All valve and sprinkler supervision switches shall be operated to verify proper response.

5) All valve and sprinkler supervision switches shall have one wire removed to verify proper supervision.

6) Each alarm output, detection or supervision zone AUG be tested for proper response to ground conditions.

7) Test to NDU/Dialer zone.

8) *AC power shall be interrupted for 24 hours (or 4 hours when backed up by generator) and followed by a 5 minute alarm test.

9) Test all detectors for alarm operation.

10) Test all signaling devices for proper operation. Devices that fail and are replaced will require a retest.

11) Test all alarm sounding devices for proper operation.

12) *Audibility tests will be conducted by the Contractor to determine compliance with the dBA requirements. For replacement systems in occupied buildings, the audibility test shall be conducted after normal working hours.

13) Test for proper operation of the Public Address portion of the FACP.

14) Test magnetic door closers, holders, locking mechanisms. Verify appropriate priority with security and access control systems.

15) Test transfer to emergency power, where provided.

16) Test alarm verification function. Confirm no delay occurs if two detectors are activated.

17) Confirm analog sensor adjustable sensitivity function is operable and properly set.

18) Confirm functional performance test with system response matrix.

C. Pressure differential report:

1. A report of the pressure differential between sampling tubes shall be provided to the UW Fire Alarm Shop. Pressure differential between intake and exhaust tubes is required to meet manufacturer specifications.

D. Smoke sensor sensitivity: Following completion of the preliminary test, the Contractor shall place the FACP online with outputs bypassed for a period of 10 days.

1. A report of all system smoke sensors with sensor high and low readings and recommendations for alarm threshold settings, and device relocation if necessary, shall then be submitted to the Owner.
2. Smoke detectors with a reading of 95 and higher are considered dirty and will be required to be cleaned or replaced for final acceptance of the system.
3. The Contractor shall then adjust detector sensitivity as directed by the Owner.

E. After satisfactory completion of the preliminary testing, the Owner will arrange for the SFD to witness a final Contractor-executed acceptance test of the system.
   1. Final acceptance will be granted jointly by the SFD and the UW Fire Protection Engineer or the Owner’s designated representative.
   2. Approval of the AHJ shall be evidenced in writing and a copy forwarded to the Owner.
   3. The requirements for final testing shall be as requested by SFD at the final test.

4.3 OTHER ITEMS
   A. At the completion of the installation when the as-built drawings have been submitted and accepted, the Contractor shall submit a letter to the UW certifying that the fire alarm system is completely functional and conforms to all applicable codes, ordinances, and requirements of the contract.

   B. Submit installation permit from the AHJ to the UW Construction Coordinator.

4.4 PROJECT COMPLETION
   A. Project completion and payment will be based on the following:
      1. Completion and approval of acceptance tests
      2. Completion of punch list items
      3. Delivery and acceptance of the as-built drawings and operation and maintenance manuals
      4. Cleanup of installation site to the satisfaction of the University’s representative

END OF SECTION