The Architect or Engineer Stamp on this page applies to all portions of the Specifications below.

ARCHITECT:
Carletti Architects, P.S.
116 E. Fir Street, Suite A
Mount Vernon, WA 98273
360-424-0394 ext. 101
Specification Divisions 1-14

STRUCTURAL ENGINEER:
Davido Consulting Group, Inc.
2124 Riverside Drive, Suite 211
Mount Vernon, WA 98273
(360) 899-1110 ext 301
Specification Divisions 5 & 6

MECHANICAL ENGINEER:
Harris Group
20201 Cedar Valley Rd., Ste. 120
Lynnwood, WA 98036
(206) 494-9515
Specification Divisions 22 & 23

ELECTRICAL ENGINEER:
K Engineers, Inc.
208 Third St.
Lynden, WA 98264
(360) 354-4757 ext 200
Specification Divisions 26 & 27

CIVIL ENGINEER
Sound Development
1111 Cleveland Ave, Suite 202
Mount Vernon, WA 98273
(360) 404-2010 ext. 1
Specification Divisions 31, 32 & 33

END OF ARCHITECTURAL / ENGINEERING STAMPS
CONDITIONS OF THE CONTRACT

00 11 13 Advertisement for Bids
00 21 13 Instructions to Bidders
00 42 13 Form of Proposal Part A: Base Bid & Alternate Bids
00 50 00 Agreement between Owner and Contractors
00 72 00 General Conditions for Washington State Facilities Construction with Washington State University Amendments
          Geotechnical Report

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01 11 00 Summary of Work
01 26 00 Change Order Procedures
01 29 00 Applications for Payment
          Current Prevailing Wage Rates
01 29 73 Schedule of Values
01 31 19 Project Meetings
01 31 23 Coordination
01 32 13 Progress Schedule
01 32 33 Construction Photographs
01 33 00 Submittals
01 35 16 Alteration Procedures
01 41 00 Regulatory Requirements
01 41 19 Special Provisions
01 45 00 Quality Control
01 45 23 Testing Laboratory Services
01 45 34 Contract Performance Evaluation Program
01 50 00 Construction Facilities & Temporary Controls
01 60 00 Material and Equipment
01 70 00 Project Close-Out
01 71 23 Field Engineering
01 74 19 Construction Waste Management
01 78 23 Operation & Maintenance Manuals
01 78 39 Project Record
01 81 19 Indoor Air Quality Management Plan

DIVISION 03 CONCRETE

03 30 00 Cast In Place Concrete
03 30 01 Concrete Floor Slabs
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DIVISION 05 METALS

05 12 00 Structural Steel
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<td><strong>DIVISION 32</strong> EXTERIOR IMPROVEMENTS</td>
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<td>Storm Utility Drainage Piping</td>
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END OF SECTION 00 01 10
Sealed bids are being requested by the Board of Regents of Washington State University, for the above referenced project.

Project Scope:

Construct a 1,800 SF wood-framed Head-house on the WSU Mount Vernon Research and Education Center to support future greenhouses. Building includes office space with restroom and shelled lab space and potting areas. Underground utilities will be extended to the building. Contract Time shall be 250 Days from Notice to Proceed to Substantial Completion. Proposals MUST BE based on this Contract Time.

Project is located at 16650 State Route 536, Mount Vernon, WA 98273

Bid Estimate: $525,000.00 to $550,000.00

Bids will be received prior to 2:00 p.m.; Tuesday, March 24, 2020 at Facilities Services, McCluskey Services Building, 2425 East Grimes Way, Pullman, WA 99164-1150. Proposals will then be publicly opened and read aloud in room 190D, McCluskey Services Building. Interested parties may call into the meeting by dialing 250-215-8782, and entering access code 117 291 697.

A pre-bid conference for general contractors will be held at 10:00 AM on March 10, 2020 at the Mt. Vernon Agriculture Research & Technology Building (ARTB), Room 101. Address is 16650 State Route 536, Mount Vernon, WA (Northwest Washington Research & Education Center).

Parking on the Pullman campus is enforced 24 hours a day, every day. It is bidder’s responsibility to obtain parking permits to attend the bid opening. Daily permit rates may be found at: http://transportation.wsu.edu/TempFees.html. Identify the meeting and project when obtaining the permit to receive appropriate rates.

Bid documents may be obtained at https://facilities.wsu.edu/facilities-services-capital contractors/. Contractors who would like to be included on the Planholder’s list shall either attend the pre-bid meeting or request to be added by emailing contracts@wsu.edu.

Printing Disclaimer: The bidding documents are available for all interested bidders and plancenters. The University does not provide printing services; it is the bidder’s responsibility to print the drawings to the appropriate scale indicated. We encourage the use of professional printing shops.

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

Maja S. Huff
509-335-9082
Contracts@wsu.edu
Facilities Services
Washington State University
PART 1  GENERAL

1.01  PROJECT IDENTIFICATION

A.  Refer to the Advertisement for Bids for Project identification, availability of bidding documents, Prebid Conference, and Contract completion date. Refer to Summary of Work, Section 01 11 00, for a brief description of the Work.

1.02  BIDDER QUALIFICATIONS

A.  Contractor Registration:

1.  Bidders subject to the Contractor's Registration Act (RCW Chapter 18.27) must show their State of Washington Contractor's license number on the Form of Proposal. In addition, bidders are cautioned to verify that all subcontractors submitting bids are also registered and licensed in accordance with the laws of the State of Washington. Owner is prohibited by virtue of RCW 39.06.010 from executing any Contract for public works with any contractor who is not registered or licensed in accordance with the laws of this state. Prior to submitting a bid, bidder must obtain an appropriate clearance and license to do business in the State of Washington as follows:

a.  Contractor's License: Make license application to the Department of Labor and Industries, Contractor's Registration, P.O. Box 7689, Olympia, Washington 98504.

b.  Registration Number: Out-of-State Contractors must obtain a registration number and permission to do business in the State of Washington from the Secretary of State, Olympia, Washington 98501.

c.  Other Registrations: Register with the State Department of Revenue as a contractor engaging in business in this state and register with the State Department of Labor and Industries and the Employment Security Department.

2.  Payment and Performance Bonds:

a.  Bidders must be able to furnish satisfactory separate Payment and Performance Bonds for full amount of the initial Contract Sum, plus sales tax.

1.03  EXAMINATION OF SITE AND CONTRACT DOCUMENTS

A.  Before submitting a bid or proposal, bidders shall carefully examine the Contract Documents, visit the Project site, and fully inform themselves as to all existing conditions and limitations, and shall include in their bid or proposal a sum to cover the cost of all items included in the Work, and shall rely on their own examination in making their bid or proposal. No change in the Work, the
Contract Sum, or the Contract Time will be allowed for issues that would have been reasonably apparent by the foregoing examination.

B. 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 Project site, including all exploratory work done by Owner, as well as from the Drawings and Specifications made a part of the Contract Documents.

C. Bidder acknowledges that adjoining areas will be in normal course during the Work. Bidder should anticipate pedestrian and traffic congestion, limited parking, and the need to coordinate all Work with ongoing operations.

D. 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 Owner. If appropriate, Owner will send written instructions to all bidders by addenda. Questions received less than 7 Days before the time of bid opening may not be answered. All issued addenda shall be incorporated into these Contract Documents.

1.04 PREBID CONFERENCE

A. All bidders are encouraged to attend a pre-bid conference. Refer to the Advertisement for Bids for the date, time and location.

B. Parking on the Pullman campus is enforced 24 hours a day, every day. It is bidder’s responsibility to obtain parking permits to attend the bid opening. Due to the possibility of parking at multiple locations on campus, bidders are advised to consider obtaining Orange Temporary Permits. Go to http://transportation.wsu.edu/TempFees.html for more information about parking permits.

1.05 CLARIFICATIONS

A. Should bidders find discrepancies in, omissions from, or unclear information within the Contract Documents, they should notify Owner at once. Owner shall issue a written instruction in the form of an addendum to all bidders. Neither the Owner nor Architect/Engineer will be responsible for any oral instructions. Questions received less than 7 Days before bid opening may not be answered. All addenda issued prior to the opening of bids will be incorporated into the Contract.

1.06 SPECIFIED PRODUCTS

A. Bids must be based upon items identified in the Specifications or approved substitutions. In certain cases, specific items have been named because of operational or maintenance considerations; approval of substitutions should not be assumed.
B. Requests for approval of substitutions must be made in writing and received by Owner at least 7 Days prior to the date of bid opening. Said request must include complete descriptions, technical data, and performance records. Any approval of the proposed substitution will be made by addendum issued to all bidders.

C. To submit substitution requests prior to Bid opening:

1. Only one substitution request per bidder will be considered for each product.
2. Requests for substitutions shall provide sufficient data to allow Owner to evaluate the suitability of the proposed product. Bidder must clearly identify product and model number of proposed substitution.

D. By requesting a substitution, bidder represents and warrants that (1) it has personally investigated the proposed material or product and determined that it is equal or better in all respects to that specified, (2) the same or better warranty will be provided for the substitution, (3) it has coordinated with affected subcontractors, (4) the substitution will not impact other parts of the Work, (5) the aggregate costs associated with the substitution actually reduces its bid amount, (6) all costs associated with the substitution are included in its bid, and (7) it waives any known or unknown future claim for an increase in the Contract Sum or Contract Time associated with the substitution.

E. Owner retains full discretion over whether to approve a substitution, and Owner's approval does not relieve bidder of the above requirements.

1.07 TAXES

A. State of Washington 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, cranes, air compressors, bulldozers, lubricating oil, sandpaper, form lumber, and similar items of material and equipment which are primarily for use by the bidder rather than for resale as a component part of the finished work, shall be included in the bid price. (See WAC 458-20-170 (State Department of Revenue Rule 170))

B. Sales tax applicable to the Contract Sum will be added to the Contract Sum by Owner at the time the Contract (Section 00 50 00) is written and shall be paid to Contractor. Contractor shall then remit payment for the sales tax to the State Department of Revenue in conformance with the law.

1.08 FILING FEES

A. Applicable state laws concerning prevailing wages, hours, workers' compensation, and other conditions of employment are called to the attention of bidders for their compliance. Bidders shall include in their bid any and all fees, including filing fees, required to comply with applicable labor laws.
1.09 PAYMENT AND PERFORMANCE BONDS

A. Upon award of the Contract, the successful bidder will be required to provide Owner with satisfactory separate payment and performance bonds. Cost of bond premiums must be included in the bidder's proposal.

1.10 FORM OF PROPOSAL

A. Proposals must be formatted in accordance with the following:

1. Bidder must utilize the Form of Proposal, examples of which are included in the Contract Documents; all numbers must be clearly and legibly stated both in writing and in figures; and signatures must be in longhand.

2. Bids must not contain any recapitulation of the Work to be done.

3. Bidders must include prices for all Alternate Bid items if they are included in the Form of Proposal.

   a. Bidders shall bid upon all Alternates indicated in the Form of Proposal. When bidding on alternates for which there is no charge, bidder shall write the words "No Charge" or some similar designation in the space provided on the Form of Proposal. 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.

4. Each part of the Form of Proposal must be sealed in its own opaque envelope and marked "Proposal: Mount Vernon Install Head-House". Bidders name shall appear on the outside of this sealed envelope. All bids are to be delivered or mailed to Facilities Services, P.O. Box 641150, 100 McCluskey Services Building, Washington State University, Pullman, WA 99164-1150. If mailed, the proposal envelope shall be enclosed in an additional envelope for mailing.

5. Bids will be received in the following form on the dates and at the times indicated in the Advertisement for Bids.

6. Proposal:

   a. Completed proposal indicating the following:

      1) Base Bid and Alternate Bid (if any) amounts;

      2) Acknowledgment of Addenda received;

      3) Signature, Corporate Identification, and Contractor License number; and

      4) Bid Security to be attached to Part A proposal form.

7. Proposal Part B (Second Submittal): NOT USED

8. All proposals will remain sealed until the bid opening. Bidders may, at their option, submit a single fully completed proposal (Parts A and B of

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9. An official clock, at the office location designated for receipt of bids, will be designated by Owner for determining the timely receipt of each bid.

B. Proposals received and determined untimely by Owner, may be considered as non-responsive and will be returned to bidder unopened.

C. Bids will be received until the respective times indicated in the Advertisement for Bids. They must be received prior to the respective times stated; i.e., where bids for Part A are required until 2:00 p.m., all bids received by 1:59:59 p.m. are timely; all bids received on or after 2:00:00 p.m. are untimely.

D. Bidders are solely responsible for delivery of their proposals at the specified location and before the specified time set for receipt of bids.

1.11 BID ALTERNATES, ALLOWANCES AND UNIT PRICES

A. Bid Alternates, Allowances, and Unit Prices adjust the Project scope by adding, deleting, or modifying specific parts of the Work as stated hereinafter.

B. An Alternate is an amount proposed by bidders and stated on the Bid Form for certain construction activities defined in the bidding documents that may be added to or deducted from the Base Bid amount and/or the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Each bidder shall submit, on the Form of Proposal, an amount for each Bid Alternate stating the difference in cost from the Base Bid amount for adding, deleting, or modifying specific materials and/or construction.

2. The difference in cost shall include all deletions, additions, and adjustments to all trades as may be necessary by each modification.

3. Only Alternates authorized by these specifications or pursuant to addenda will be considered.

C. An Allowance is an amount established in the Contract Documents for inclusion in the Contract Sum to cover the cost of prescribed items not specified in detail sufficient to estimate at time of bid.

1. Each bidder shall include in the Base Bid amount the amount for each Allowance as identified in the bidding documents.

D. A Unit Price is an amount as a price per unit of measurement for materials or services added or deleted from the Base Bid amount.

1. Each bidder shall submit on the Bid Proposal Form, an amount for each Unit Price stating the difference per unit or measurement for materials or services added or deleted from the Base Bid amount.
2. The Unit Price stated shall be used as the amount for either adding or deleting the item per unit of measurement from the Work.

3. The Unit Price amounts submitted on the Form of Proposal shall be used as the cost per unit of measurement for the entire duration of the Contract.

1.12 BID GUARANTEE

A. Bidder shall furnish a bid guarantee in the form of a cashier's check or bid bond made payable to the Board of Regents of Washington State University for an amount equal to at least 5% of the total Base Bid amount, as evidence of good faith and as a guarantee that, if awarded the Contract, the bidder will execute the Contract and provide payment and performance bonds as required.

B. Should the successful bidder fail to enter into a Contract and furnish satisfactory bonds within 10 Days after its proposal has been accepted, the bid security shall be forfeited as liquidated damages.

C. Owner reserves the right to hold the bid guarantee of the 3 lowest bidders until the successful bidder has entered into a contract and furnished required bonds.

1.13 MWBE PARTICIPATION

A. Washington State University is committed to the enhancement of opportunities for minority and women owned and controlled businesses in public contracting. The use or solicitation of minority and women's business enterprise firms is expressly encouraged.

1.14 CONTRACTOR AND SUBCONTRACTOR PARTICIPATION – NOT USED

1.15 MODIFICATION OF PROPOSALS

A. Modifications to proposals already submitted will be permitted only if requested in writing over the signature of the bidder and provided such requests are received prior to the time set for receipt of bids.

B. The original Form of Proposal will remain unopened until bid opening. Modifications in the form of facsimile transmissions will not be accepted.

C. Withdrawal of proposals will be permitted only if requested in writing over the signature of the bidder and provided such requests are received prior to the time set for receipt of bids.

D. Withdrawal requests in the form of facsimile transmissions will not be accepted.

E. After the scheduled closing time for the receipt of Form of Proposals, no bidder will be permitted to withdraw a proposal unless said award is delayed for a period exceeding 60 Days.
1.16 ALTERATIONS PROHIBITED

A. Except as otherwise provided herein, Forms of Proposal which are incomplete, or which are conditioned in any way, or which contain items not called for in the Proposal Form, or which are not in conformity to the law, may be rejected.

B. The Form of Proposal invites bids on specific Drawings and Specifications. Only the amounts and information asked for on the Form of Proposal furnished will be considered.

1.17 BID PROTEST PROCEDURES

A. A bidder protesting for any reason the bidding documents, a bidding procedure, the University's objection to a bidder or a person or entity proposed by the bidder, including but not limited to, a finding of non-responsibility, the award of the Contract or any other aspect arising from, or relating in any way to, the bidding, shall file a written protest with the University within two (2) business days of the event giving rise to the protest. (Intermediate Saturdays, Sundays, and legal holidays are not counted as business days.) The written protest shall include the name of the protesting bidder, the title of the bid under which the protest is submitted, a detailed description of the specific factual and legal grounds for the protest, copies of all supporting documents, evidence that the apparent low bidder has been given notice of the protest, and the specific relief requested. The written protest shall be sent by email to contracts@wsu.edu.

B. Upon receipt of the written protest, the University will consider the protest. The University may, within three (3) business days of the University's receipt of the protest, provide any other affected bidder(s) the opportunity to respond in writing to the protest. If the protest is not resolved by mutual agreement of the protesting bidder and the University, the Assistant Vice President for Facilities Services, Capital of the University, or her or his designee, will review the issues and promptly furnish a final and binding written decision to the protesting bidder, and any other affected bidder(s), within six (6) business days of the University's receipt of the protest. (If more than one (1) protest is received, the University’s decision will be provided within six (6) business days of the University’s receipt of the last protest.) If no reply is received from the University during the six (6) business-day period, the protest will be deemed rejected.

C. Failure to comply with these protest procedures will render a protest waived.

D. Timely and proper compliance with, and exhaustion of, these protest procedures shall be a condition precedent to any otherwise permissible judicial consideration of a protest.

1.18 LOW RESPONSIBLE BIDDER

A. It is the intent of Owner to award the 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 Owner to submit documentation demonstrating compliance with the criteria. 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).
5. 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 first date of advertising for this project.
6. Not have been determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries, or through a civil judgment entered by a court of limited or general jurisdiction, to have willfully violated, any provision of chapter 49.46, 49.48, or 49.52 RCW, as defined in RCW 49.48.82.

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

1. The ability, capacity, and skill of bidder to perform the service required;
2. The experience and efficiency of bidder;
3. Whether bidder can perform the Contract within the time specified;
4. The satisfactory completion of previous contracts or services;
5. Such other information having a bearing on the decision to accept a bid proposal.

C. Whenever Owner evaluates Contractor’s responsibility, the foregoing may be taken into account. In addition to Contractors experience, evaluation of bidder’s responsibility will also be based on the documented experience of the Project Manager, Project Engineer, and the Superintendent proposed for the Project. A minimum of five-years experience or three projects of comparable size and scope to this Project will be required for Contractor’s Project Manager, Project Engineer, and superintendent.
D. For projects involving research and laboratory space, or a combination of research, laboratory, and office space, the required experience for bidder, Project Manager, Superintendent, and Project Engineer shall be as follows:

1. Bidder shall have documented experience as a GC on projects of similar type, value, and scope for a minimum of eight years or three projects.

2. The Project Manager shall have documented experience managing and planning projects of similar type, value, and scope as the Contractor’s Project Manager for a minimum of five years or three projects.

3. The Superintendent shall have documented experience directing daily activities of all subcontractors on projects of similar type, value, and scope as the GC’s Superintendent for a minimum of five years or three projects.

4. The Project Engineer shall have documented experience coordinating and administering the work on projects of similar type, value and scope as the GC’s Project Engineer for a minimum of three years or two projects.

E. Within 48 hours of receipt of request, apparent low bidder will provide such information about its team as Owner determines to be reasonably necessary to evaluate the responsibility of the bidder. Failure to reply with requested information will render a bidder non-responsible at Owner’s option. At minimum, a bidder shall provide:

1. A financial statement;

2. List of projects currently under construction, including current contract amount and status of each;

3. Names and resumes of proposed Project Manager, Project Engineer, and Superintendent;

4. Name of bonding company/agent; and

5. References including project and owner name, a project contact, and project contact telephone number.

F. As evidence that bidder meets the bidder responsibility criteria, the apparent low bidder must submit documentation as may be required above to the Owner within 48 hours of the bid submittal deadline. Owner reserves the right to request such documentation from other bidders also.

G. Owner will review Contractor’s past Contract Performance to assist in evaluating the contractor’s qualifications and proven ability to successfully perform future contracts only when past performance has been previously documented via the Contract Performance Program.

H. If Owner determines bidder does not meet the bidder responsibility criteria above and is therefore not a responsible bidder, Owner shall notify bidder in writing with the reasons for its determination. If bidder disagrees with this determination, it
may appeal the determination within 24 hours of receipt of Owner’s determination by presenting additional information to Owner. Owner will consider the additional information before issuing its final determination. If the final determination affirms that bidder is not responsible, Owner will not execute a Contract with any other bidder until 2 business days after the bidder determined to be not responsible has received the final determination.

1.19 CONTRACT AWARD

A. Owner intends but is not required to enter into a contract with the successful bidder, for all Work called for in the Contract Documents.

B. The determination of the successful bidder will be made on the basis of the sum of the Base Bid together with Owner-selected Alternates.

C. The responsibility of bidder and its subcontractors will be considered in making the award. Owner reserves the right to reject any or all bids and to waive informalities advantageous to Owner and/or the protection of the public interest.

D. Reinstatement of Bid Alternate not initially selected shall be in accordance with provisions of the Bid Proposal Form of Proposal.

1.20 CONTRACT FORMS

A. Owner’s standard form Contract is included with the Contract Documents.

END OF SECTION 00 21 13
Mount Vernon Install Head-House
Mount Vernon, WA

Refer to Instructions to Bidders for bid submittal procedures.

Bidder's Firm Name: _______________________________ Date: ___________

To: Facilities Services, Capital
McCluskey Services Building, P.O. Box 641150
Washington State University
Pullman, Washington 99164-1150

Pursuant to and in compliance with the Advertisement for Bids and the Instructions to Bidders, the Bidder, having carefully examined the Contract Documents entitled "Mount Vernon Install Head-House" and having visited the Project site and examined the conditions affecting the Work, hereby proposes and agrees to provide all labor, materials, equipment, services, and incidentals necessary to complete the Work for the following stipulated sums:

A. BASE BID

________________________________________________________________________

________________________________________________________________________ DOLLARS ($_______________),

B. UNIT PRICES – NOT USED

C. ALTERNATES – NOT USED

D. REINSTATEMENT OF BID ALTERNATES – NOT USED

E. SALES TAX

The Bidder agrees that the amounts indicated in the proposal do not include Washington State and local sales taxes except as required by the Instructions to Bidders.

F. CONTRACT PROVISIONS

Should the Bidder be notified of the acceptance of this proposal within 60 Days from the date set for the opening thereof or at any time thereafter before this proposal is withdrawn, the bidder agrees to execute a Contract for the Work and to furnish the required bonds.

1. TIME OF COMPLETION

The bidder agrees, if awarded a Contract for the Work, to complete the Work within the Contract Time specified.
2. LIQUIDATED DAMAGES
The bidder agrees that time is of the essence of the Contract and acknowledges that the amount of damages specified is a measure of the damages which the Owner will sustain should the Bidder fail to complete the Work within the Contract Time.

G. BID GUARANTEE
The Bidder agrees that the bid guarantee accompanying the Part A Form of Proposal is left in escrow with Owner, that the amount of the guarantee is the measure of the damages that Owner will sustain by failure of the bidder to execute a Contract for the Work and furnish required bonds, and that if the bidder fails to deliver said documents within 10 Days after receipt of notice of award to the bidder, the bid guarantee shall become the property of Owner.

H. MINORITY AND WOMEN'S BUSINESS ENTERPRISE (MWBE) PARTICIPATION
Owner is committed to the enhancement of opportunities for minority and women owned and controlled firms in public contracting. While neither required, nor a part of bidder responsiveness, the use or solicitation of minority and women business enterprises is expressly encouraged.

I. CONTRACTOR AND SUBCONTRACTOR PARTICIPATION – NOT USED

J. ADDENDA
The bidder hereby acknowledges receipt of Addendum by number(s):

K. PREVAILING WAGE CERTIFICATION
The bidder has not been determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries, or through a civil judgment entered by a court of limited or general jurisdiction, to have willfully violated, any provision of chapter 49.46, 49.48, or 49.52 RCW, as defined in RCW 49.48.82.

L. DECLARATION
The bidder represents and warrants that he/she possess the authority to sign for and bind bidder.

The Bidder declares under penalty of perjury under the laws of the State of Washington, that all of the foregoing information as recited is true and correct to the best of his/her knowledge.

Bidder’s Firm Name: ________________________________
Signed By: ____________________________________ Official Title: __________________
Print Name: ________________________________
Address: ________________________________________________
City: ___________________________ State: _______________ Zip Code: _______
Telephone: ____________________ Fax: ________________________
State of Washington Contractor’s License Number: _______________________
Federal Tax Identification Number: ________________________________
Email Address: _________________________________________________
The firm represented by the above signature is a:
Sole Proprietorship ____________
Partnership ____________
Corporation ____________ State of Incorporation ____________________
Other ____________

END OF SECTION 00 42 13
This AGREEMENT is effective as of the date of the first signature on the Agreement so long as all other parties’ authorized signatories have also executed the Agreement. This Agreement is made by and between the following parties in connection with the Project identified below.

OWNER: Washington State University  
c/o Facilities Services, Capital  
P.O. Box 641150  
Pullman, WA 99164-1150

CONTRACTOR: [To be determined]

ARCHITECT (A/E): Carletti Architects P.S.  
116 E. Fir Street, Suite A  
Mount Vernon, WA 98273

PROJECT: Mount Vernon Install Head-House  
16650 State Route 536  
Mount Vernon, WA 98273

In consideration of the mutual covenants and obligations contained herein, Owner and Contractor agree as set forth herein.

**Article 1**  
**The Work of the Contract**

1.1 **Contractor to fully execute the Work.** Contractor shall fully execute the entire Work in strict accordance with the Contract Documents, and shall provide all material, equipment, tools, and labor necessary to timely complete the Work described in and reasonably inferable from the Contract Documents, except to the extent specifically indicated to be the responsibility of others.

1.2 **Contractor to further Owner’s interests.** Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with Owner to cooperate and collaborate with Owner and others involved with the Project and to exercise Contractor’s best skill and judgment; to furnish efficient, professional construction administration, management services and supervision with sufficient quantities of fully qualified, competent and experienced personnel; and to perform the Work in an expeditious and economical manner consistent with Owner’s interests. The parties will endeavor to promote harmony, cooperation and mutual respect among the Project participants to the fullest extent possible in order to further the success of the Project and to effect prompt and successful completion of the Project within the requirements of the Contract Documents, the Contract Time and the Contract Sum.
Article 2
Contract Documents

2.1 The Contract Documents. The “Contract Documents” form the “Contract.” The Contract Documents consist of this Agreement (Agreement between Owner and Contractor or the “Agreement”); any attached Exhibits and other documents listed in the Contract Documents; the General Conditions; other documents listed in Article 8 of this Agreement; and written modifications, amendments and Change Orders to the Contract issued after execution of this Agreement.

2.2 Contract is complete and integrated agreement. The Contract represents the entire, complete, and integrated agreement between the parties and supersedes prior negotiations, representations or agreements, either written or oral. No oral representations or other agreements have been made by the parties except as specifically established in the Contract.

2.3 Contract is between only Owner and Contractor. The Contract Documents shall not be construed to create a contractual relationship of any kind between any Persons other than Owner and Contractor.

Article 3
Definitions

3.1 Terms, words and phrases to have ordinary meanings. Terms, words and phrases used in the Contract Documents shall have the meanings given them in this Agreement and in the General Conditions or, if not defined, in a manner consistent with construction industry standards. In the event of any inconsistency in such definitions, the definitions in this Agreement shall control.

3.2 Construction Documents. The Construction Documents are identified in the General Conditions and other Contract Documents as Drawings and Specifications. The Construction Documents do not include shop drawings or other Submittals.

3.3 Contractor. “Contractor” is the Person identified as such in the Agreement and General Conditions. Contractor must be licensed, bonded, and insured as a contractor in the State of Washington, and must legally be permitted to do business. Contractor’s authorized representative, including its Designated Representative, shall be authorized to act on Contractor’s behalf with respect to the Project.

3.4 General Conditions modified. Section 4.03E of the General Conditions is hereby modified to clarify that Contractor and Owner may agree on the number of copies of Submittals to be provided to Owner. If no such agreement is reached, Contractor shall submit five copies.

Article 4
Notice to Proceed and Substantial Completion

4.1 Notice to Proceed. The date of Notice to Proceed will be specified in a written Notice issued by Owner. Owner may issue separate written authorizations to proceed for different portions of the Work.
4.2 **Contract Time measured from date of commencement.** The Contract Time shall be measured from the Notice to Proceed date to the contractual date of Substantial Completion established in Section 4.3, subject to adjustments as provided in the Contract Documents. Time is of the essence in completion of the Work.

4.3 **Substantial Completion and Final Completion.** Contractor shall achieve Substantial Completion of the Work within two hundred fifty (250) Days following Notice to Proceed, subject to adjustments as provided in the Contract Documents, and shall achieve Final Completion not later than sixty (60) Days thereafter. Contractor represents to Owner that the Contract Time is adequate for full performance of the Work. Contractor shall also achieve any interim milestones and phasing requirements set forth in the Contract Documents.

4.4 **Liquidated damages.** Owner will assess, and Contractor will be responsible for, liquidated damages in the amount of Three hundred two dollars and eight cents ($302.08) per Day for each Day beyond the contractual date for Substantial Completion that Substantial Completion is not timely achieved, and subsequently Two hundred seventy-nine dollars and eight cents ($279.08) per Day for each Day beyond the time period established in Section 4.3 that Final Completion of the entire Work is not achieved. Contractor and Owner agree that the liquidated damages amounts are not penalties and are a reasonable estimation of actual damages to Owner, as of this date of Agreement, based on the inherent uncertainty and difficulty in calculating and quantifying damages caused by delays in the construction of university facilities.

### Article 5
**Contract Sum**

5.1 **Contract Sum.** For Contractor’s performance of the Contract, Owner shall pay to Contractor the Contract Sum of [dollars ($__________)], subject to additions and deductions for changes in the Work as provided in the Contract Documents. The Contract Sum includes by way of example and not limitation all costs of construction; general conditions; all taxes except Washington State sales tax due on the Contract Sum; Contractor’s contingency; any approved Allowances; all insurance; overhead; and Contractor’s fee.

5.2 **Alternates.** The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by Owner:

<table>
<thead>
<tr>
<th>Alternate Number</th>
<th>Description</th>
<th>Price ($0.00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.3 **Unit Prices.** Any Unit Prices are as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Price ($0.00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
connection with, or incidental to, the performance of that portion of the Work to which such Unit Prices apply.

5.4 Allowances. Allowances included in the Contract Sum are as follows:

<table>
<thead>
<tr>
<th>Allowance</th>
<th>Amount</th>
<th>Included Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Allowances may be included in the Contract Sum due to uncertainty in scope, price and/or quantity at the time this Agreement is executed. Whenever actual costs are more or less than an allowance, the Contract Sum will be appropriately adjusted. Contractor must provide Owner with written notice of its intent to expend an allowance amount (providing Owner with the opportunity to approve or reject the cost) before expending an allowance amount.

5.5 Changes in the Work.

5.5.1 Owner may, without invalidating the Contract, order changes in the Work consisting of additions, deletions or other revisions. Owner shall issue such changes in writing.

5.5.2 Adjustments of the Contract Sum and/or Contract Time on account of changes in the Work may be determined by any of the methods listed in the General Conditions.

Article 6
Payments

6.1 Applications for Payment.

6.1.1 The Contract Documents detail the requirements for Applications for Payment. Based upon Applications for Payment that Contractor submits to Owner, Owner shall make progress payments to Contractor on account of the Contract Sum.

6.2 Progress Payments.

6.2.1 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows and in accordance with Section 01 29 00, Applications for Payment:

1. Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage of completion of each portion of the Work by the share of the Contract Sum allocated to that portion in the Schedule of Values. Pending final determination of the cost to Owner of changes in the Work, amounts not in dispute may be included as provided in the General Conditions unless Owner requires that actual cost records be provided;

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

3. Subtract the aggregate sum of previous payments made by Owner;
.4 Subtract amounts, if any, for which Owner has withheld payment; and

.5 Subtract the statutory retainage of five percent (5%) of the above amount as a fund for the protection and payment of the claims of any Person arising out of the Work and the State of Washington with respect to taxes.

6.3 Final Payment.

6.3.1 Final payment, constituting the entire unpaid balance of the Contract Sum, less retainage, shall be made by Owner to Contractor no later than 30 Days after Contractor has fully performed the Contract and Final Completion has occurred (except for Contractor’s responsibility to correct non-conforming Work discovered after final payment or to satisfy other requirements, if any, that extend beyond final payment), and Contractor has submitted a final Application for Payment.

6.3.2 Owner shall release retainage to Contractor in accordance with Chapter 60.28 RCW and the Contract Documents.

Article 7
Miscellaneous Provisions

7.1 Designated Representatives.

7.1.1 Owner’s Designated Representative, designated below, shall be authorized to act on Owner’s behalf with respect to the Project:

<table>
<thead>
<tr>
<th>Cynthia Arbour</th>
<th>Dan Goton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager</td>
<td>Facilities Manager</td>
</tr>
<tr>
<td>Facilities Services, Capital</td>
<td>WSU Mt. Vernon REC</td>
</tr>
</tbody>
</table>

7.1.2 Contractor’s Designated Representative, identified below, shall be authorized to act on Contractor’s behalf with respect to the Project:

7.1.3 Neither Owner’s nor Contractor’s Designated Representatives shall be changed without 10 Days’ written notice to the other party.

7.2 Interest. Payments due and unpaid under the Contract Documents shall bear interest as specified by RCW 39.76, not to exceed the Bank of America prime plus two percent (2%) per annum.

7.3 Quality control and assurance and Owner’s right to inspect the Work: Contractor shall develop and submit an overall Quality Control and Assurance Plan to ensure that the Work is inspected by qualified members of Contractor’s staff or third parties. The Quality Control and Assurance Plan must be acceptable to Owner. Owner expressly reserves the right to inspect any and all portions of the Work at any time during the Project. Contractor shall provide access to the Work as needed by Owner or its representatives, including the use of scaffolding, platforms, or lifts. All corrections or observations noted by Owner shall be logged by Contractor for
correction, tracking and documentation to the satisfaction of Owner.

7.4 Contractor to actively manage and supervise Work. Contractor shall review and inspect the Work of Subcontractors on a regular basis for defects and deficiencies in their Work and for conformance with the Construction Documents and other Contract Documents, and shall stop the Work of Subcontractors, if necessary. Contractor shall provide notification at regularly scheduled progress meetings of any major defects or deficiencies and recommend remedial action.

7.5 Use of Third Party Neutral. Owner and Contractor intend to utilize a Third Party Neutral to assist in addressing and resolving disputes that may arise during the Project. The Third Party Neutral will be jointly engaged and will have the roles and responsibilities set forth in a Third Party Neutral Agreement, which shall be established in accordance with Section 00 80 10, Third Party Neutral.

**Article 8**

**Enumeration of the Contract Documents**

8.1 The Contract Documents. The Contract Documents, except for modifications issued after execution of this Agreement, are enumerated as follows:

8.1.1 This executed Agreement, any attached Exhibits and other documents listed in this Agreement.


8.1.3 The Addenda, if any, are as follows:

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
<th>Pages</th>
</tr>
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</table>

8.1.4 Other documents, if any, forming part of the Contract Documents are as follows:

See Contract Documents.

Department of Labor and Industries Prevailing Wage Rates.

OWNER: WASHINGTON STATE UNIVERSITY

CONTRACTOR: FIRM NAME

WA CONTRACTOR LICENSE NUMBER

(Signature) (Date) (Signature) (Date)

(Printed Name) (Printed Name)

Vice President for
Finance and Administration (Title)

END OF SECTION 00 50 00
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WSU amendments to the Washington State Facility Construction General Conditions are identified by a bar on the right hand side of modified paragraphs
PART 1 - GENERAL PROVISIONS

1.01 DEFINITIONS

A. “Application for Payment” means a written request submitted by Contractor to Owner for payment of Work completed in accordance with the Contract Documents and approved Schedule of Values, supported by such substantiating data as Owner 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. An “Allowance” is an amount included in the Contract Sum for a stated part of the Work that is not fully defined and/or quantified at the time the Contract Sum is established. When that part of the Work is adequately defined and/or quantified, the Contract Sum will be adjusted to account for the difference between the Allowance and the actual cost of the item. Following the adjustment, that part of the Work will no longer be an Allowance item. Although not capitalized in Section 5.02B, “allowance” shall mean “Allowance.”

D. “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.

E. “Claim” means Contractor’s exclusive remedy for resolving disputes with Owner arising out of or relating to the Contract Documents or the breach thereof or requesting an adjustment in the Contract Sum or Contract Time, as more fully set forth in Part 8. As used in the Contract Documents, the exclusive meaning of “equitable adjustment” is the ability of Contractor to follow the contractual dispute resolution process in Part 8, including the requirement for submitting a timely Notice, substantiation, and Claim.

F. The “Contract” is the agreement between Owner and Contractor and is formed by the Contract Documents. The Contract represents the entire and integrated agreement between Owner and Contractor and supersedes prior negotiations, representations or agreements, either written or oral.

G. “Contract Award Amount” is the sum of the Base Bid and any accepted Alternates, if any, for Design-Bid-Build projects and is the accepted initial Guaranteed Maximum Price for Design-Build and GC/CM projects.

H. “Contract Documents” means the General Conditions, modifications to the General Conditions, Supplemental Conditions, Agreement, Drawings and Specifications, and all addenda and modifications thereof.

I. “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.

J. “Contract Time” is the number of Days or other time period allotted in the Contract Documents from the Notice to Proceed for achieving Substantial Completion of the Work.

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

L. “Day(s)” means calendar day(s) unless otherwise specified.
M. "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.

N. "Final Acceptance" means the written acceptance of the Work by Owner, as more fully set forth in Section 6.08B.

O. "Final Completion" means that the Work is fully and finally complete in accordance with the Contract Documents and Contractor has submitted its final Application for Payment, as more fully set forth in Section 6.09A.

P. "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.

Q. "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. Although not capitalized in the following provisions, "notice" shall mean "Notice" in Sections 3.03B, 3.03C, 3.06A, 5.01D, 5.02C, 5.03, 5.09A, 5.10A, 5.15A, 5.16F, 5.17, 9.01A, 9.02A, and 9.02B.

R. "Notice to Proceed" means a written Notice from Owner to Contractor that permits pre-construction and construction activities to commence upon specified terms and defines the date on which the Contract Time begins to run.

S. "Owner" means the Washington State University Board of Regents, which has the authority to enter into, administer, and/or terminate the Work in accordance with the Contract Documents. Owner shall designate in writing a Representative who shall have authority to bind Owner with respect to all matters requiring Owner's approval or authorization. A/E does not have such authority.

T. "Person" means a corporation, partnership, business association of any kind, trust, company, or individual.

U. "Prior Occupancy" means Owner's use of all or parts of the Project before Substantial Completion, as more fully set forth in Section 6.08A.

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

W. "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.

X. "Project Record" means the separate set of Drawings and Specifications as further set forth in paragraph 4.02A.

Y. "Schedule of Values" means a written breakdown allocating the total Contract Sum to each principal category of Work, in such detail and format as requested by Owner.

Z. "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.
AA. “Subcontract” means a contract between Contractor and a Subcontractor for the purpose of obtaining supplies, materials, equipment, work or services of any kind for or in connection with the Work. Although not capitalized in the following provisions, “subcontract” shall mean “Subcontract” in Sections 5.10A, 5.20E, 9.01B, and 9.02B.

BB. “Subcontractor” means any Person of any tier, other than Contractor, who agrees to furnish or furnishes by contract with, or through Contractor, any supplies, materials, equipment, or services of any kind in connection with the Work. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor. Although not capitalized in the following provisions, “subcontractor” shall mean “Subcontractor” in Sections 5.04B, 5.04C, 5.04G, 5.20A, and 5.21B.

CC. “Substantial Completion” means that stage in the progress of the Work (or portion of the Work designated and approved by Owner) when the construction is sufficiently complete, in accordance with the Contract Documents, so that Owner can fully occupy or utilize the Work (or portion designated by Owner) for its intended use, as more fully set forth in Section 6.07. There may be separate dates of Substantial Completion specified in the Contract Documents for various phases or portions of the Work.

DD. “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. Although not capitalized in the following provisions, “work” shall mean “Work” in Sections 3.02D, 5.04B, 5.04C, 5.07D, 5.12A, 6.02 and 7.02A.

EE. A “Work Directive” ("WD") is a binding written order prepared by Owner that directs Work prior to total agreement on adjustment, if any, in the Contract Sum or Contract Time, or both.

FF. “Work Site” means the space identified and circumscribed on construction documents. The work site is controlled by the Contractor and the Contractor is responsible for compliance to regulatory requirements within the circumscribed area. Changes to the work site shall be submitted by Contractor and approved by Owner.

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, with a revision to a Contract Document having precedence over the original document and a later document having precedence over an earlier document:

1. Signed Agreement, with any Change Orders having precedence.

2. Supplemental Conditions.

3. Modifications to the General Conditions.

4. General Conditions.

5. Specifications and Drawings. The Specifications and Drawings are complementary and shall have equal precedence. Thus, anything mentioned in the Specifications but not shown on the Drawings, or shown on the Drawings but not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both. If there is any inconsistency between the Specifications and Drawings, Contractor will make an inquiry to Owner to determine how to proceed. Unless otherwise directed, Contractor will provide the better quality or greater quantity of any Work or materials, as reasonably interpreted by Owner, at no change in the Contract Sum or Contract
1.03 EXECUTION AND INTENT

Contractor Representations: Contractor makes the following representations to Owner:

1. Contract Sum and Contract Time 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, including but not limited to (1) Certificates of Insurance on ACORD Form 25, and/or ACORD Form 27 or their equivalents, and which shall list any applicable self-insured retentions, (2) the actual costs (expressed as a percentage) of Contractor’s liability insurance under Section 2.01A.1 below, (3) applicable endorsements evidencing proof of compliance with the requirements listed below, (4) evidence of State Workers’ Compensation coverage, and (5) a copy of any builder’s risk policy required by the Contract Documents. All policies, endorsements and certificates must be signed copies and shall contain a provision that policies will not be cancelled without first giving thirty (30) days (or in the event of non-payment of premium, ten (10) days) prior written Notice to Owner. Contractor shall furnish to Owner copies of any subsequently issued endorsements amending, modifying, altering or restricting coverage terms or limits. Review of Contractor’s insurance by Owner shall not relieve or decrease the liability of Contractor. Companies writing the insurance to be obtained by Part 2 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 the Contract Sum the cost of all insurance and bond costs required for the Work. Insurance carriers providing insurance 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 Substantial Completion. 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-based ISO Form CG 00 01 or broader, including products and completed operations, personal and advertising injury, bodily injury and property damage liability arising from Contractor’s operations or Work, including operations or Work Contractor may subcontract or sublet to others.

   The policy shall be purchased from a company or companies lawfully authorized to do business in the State of Washington possessing an A.M. Best’s policyholder’s rating of A or better and a financial rating of no less than XI.

   Contractor’s policy shall be designated primary and non-contributory to Owner’s policies, and shall include a waiver of subrogation against Owner. Any self-insured retentions or deductibles must be disclosed and approved by Owner, and Contractor agrees to be responsible for payment of any and all self-insured retentions or deductibles.

2. **Automobile Liability Insurance**: Automobile liability on ISO Form CA 00 01 covering Code 1 (any auto).

3. **Stop Gap Liability Insurance** for damages because of bodily injuries to Contractor’s employees.

   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, its officers, and employees, and any required governmental agencies as additional named insureds with coverage at least as broad as ISO Forms CG 20 10, CG 20 37, and CA 20 48, with no self-insured retentions applicable to the additional insureds.

   E. **Subcontractor Coverage**: Contractor shall ensure and require that Subcontractors have insurance coverage to cover bodily injury and property damage on all operations and all vehicles owned or operated by Subcontractors. Subcontractors shall name Contractor and Owner, any required governmental agencies, and others designated in the Contract Documents as well as their officers and employees, as additional insureds and give at least thirty (30) Days’ Notice of cancellation.

### 2.02 COVERAGE LIMITS

**Insurance amounts**: The coverage limits shall be not less than the amounts specified in the Agreement; if limits are not specified in the Agreement, coverage limits shall be not less than as follows:

A. **$1,000,000 per occurrence for bodily injury, property damage, personal and advertising injury.**

B. **$2,000,000 general aggregate to apply separately to each project or location.**

C. **$2,000,000 annual aggregate for products and completed operations.**

D. **$1,000,000 combined single limit each automobile accident or loss.**
E. $1,000,000 per accident for bodily injury or occupational disease of Contractor’s employees

Coverages and Minimums: Owner’s review, specification or approval of the insurance in this Contract or of its coverage or amount shall not relieve or decrease the liability of Contractor under the Contract Documents or otherwise. Coverages are the minimum to be provided and are not limitations of liability under the Contract, indemnification, or applicable law provisions. Contractor may, at its expense, purchase larger coverage amounts.

2.03 PROOF OF INSURANCE COVERAGE

A. Certificate & endorsements required: Prior to commencement of the Work, Contractor shall furnish to Owner completed certificates of insurance coverage and endorsements evidencing compliance with the additional insured, cancellation, and waiver of subrogation requirements.

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

C. Policy: In the event of a claim or loss, Contractor shall promptly provide Owner with a complete copy of all applicable policies.

2.04 PAYMENT AND PERFORMANCE BONDS

Conditions for bonds: Payment and performance bonds for 100% of the Contract Award Amount, plus Washington State sales tax, shall be furnished for the Work, using the current version of the Payment Bond and Performance Bond form published by and available from the American Institute of Architects (AIA) – form A312. No payment or performance bond is required if the Contract Sum is $150,000 or less and Contractor requests and the Owner agrees that Owner may, in lieu of the bond, retain 10% of the Contract Sum for the period specified in RCW 39.08.010.

2.05 ALTERNATIVE SURETY

When alternative surety required: Contractor shall promptly furnish payment and performance bonds from an alternative surety 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. Owner to buy builder’s risk insurance: Owner shall purchase and maintain builder’s risk 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, an “Installation Floater” is an acceptable substitute for the builder’s risk insurance. The insurance shall cover the interests of Owner, Contractor, and any Subcontractors, as their interests may appear.

B. Losses covered: Builder’s risk insurance shall be placed on an “all risk” basis or equivalent policy form and insure against the perils of fire and extended coverage and physical loss or damage including theft, vandalism, malicious mischief, collapse, false work, flood, wind, temporary buildings, earthquake, debris removal including demolition, and shall cover reasonable compensation for A/E’s services and expenses required as a result of an insured loss. Losses up to the deductible amount shall be the responsibility of Contractor.
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 5.19, 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 2.06 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 the time period specified in the Contract Documents. If Contractor fails to perform in a timely manner in accordance with the Contract Documents and, through the fault of Contractor or Subcontractor(s), fails to meet the Progress Schedule, Contractor shall be in default and shall take such steps as may be necessary to immediately improve its progress without change in the Contract Sum or Contract Time.

**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 consistent with the requirements of the Contract Documents. The Progress Schedule shall not exceed time limits specified by the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work, and 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 submission of Submittals per Section 4.03, which shall be coordinated with the Progress Schedule and identify dates for Owner review, 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, logic 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 that meets the requirements of this Section 3.02.

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 perform the Work in accordance with the most recent Progress Schedule submitted to Owner. Contractor shall promptly notify Owner in writing of any actual or anticipated event that 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 AND/OR CARRY OUT 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 Owner has accepted satisfactory corrective action.

B. Owner may carry out the Work after Contractor’s failure to perform: If Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a 14-Day period after receipt of written Notice from Owner to commence and continue to make reasonable progress toward the correction of such default or neglect with diligence and promptness, Owner may, without prejudice to other remedies Owner may have, correct such deficiencies, and an appropriate Change Order shall be issued deducting from payments then or thereafter due Contractor the reasonable cost of correcting the deficiencies, including Owner’s expenses and compensation for A/E’s additional services made necessary by the default, neglect or failure. If payments then or thereafter due Contractor are not sufficient to cover such amounts, Contractor shall pay the difference to Owner.
C. 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 shall not constitute a default if and to the extent the cause for such delay or failure of performance was unforeseeable and beyond the control of the party. 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 not the fault of Owner or Contractor;
3. Fire or other casualty for which Contractor is not responsible;
4. Quarantine or epidemic;
5. Industry-wide 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.

   a. "Unusually severe weather" shall mean weather conditions that are abnormal for the period of time for which Force Majeure is claimed, that could not reasonably have been anticipated or avoided, and that had an adverse effect on the Progress Schedule. Neither the Contract Time nor the Contract Sum will be adjusted for normal inclement weather or if the Work was behind schedule (unless behind schedule for a reason not the responsibility of the Contractor) at the time the unusually severe weather occurred. The Contractor shall be entitled to a change in the Contract Time only (but not a change in the Contract Sum) if the Contractor can substantiate to the reasonable satisfaction of the Owner that there was unusually severe weather as compared to normal using a ten (10) year average of accumulated record mean values from climatological data compiled by the U.S. Department of Commerce National Oceanic and Atmospheric Administration for the locale closest to the Project, and that the abnormal inclement weather actually impacted and extended the critical path of the Work. Unusual is defined as a 10-year weather event of either or both precipitation or temperature extremes that fall outside the upper and lower ranges within a 10-year periodicity.

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. 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 for equitable adjustment.

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, 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. Contractor shall not recover damages, an equitable adjustment or an increase in the Contract Sum or Contract Time from Owner where Contractor could have reasonably avoided the delay by the exercise of due diligence.

G. Types of damages permitted: If Contractor and its Subcontractors are entitled to a change in the Contract Sum, the amount of the change shall be the actual costs incurred by the Contractor and Subcontractors directly related to the change calculated in accordance with Section 7.02. Contractor and its Subcontractors shall not otherwise (not reflected by the actual costs incurred as calculated in accordance with Section 7.02) be entitled to damages arising out of actual or alleged loss of efficiency; morale, fatigue, attitude, or labor rhythm; constructive acceleration; home office overhead; expectant underrun; trade stacking; reassignment of workers; rescheduling of Work, concurrent operations; dilution of supervision; learning curve; beneficial or joint occupancy; logistics; ripple; season change; extended overhead; profit upon damages for delay; impact damages including cumulative impacts; or similar damages. Any effect that such alleged events may have on Contractor or its Subcontractors, to the extent not otherwise paid, is subsumed in and fully compensated through the percentage Fee on Change Orders paid through Section 7.02A.3.e and any liquidated damages paid hereunder.

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 obligations or liabilities pursuant to the Contract Documents. If Contractor substantially fails to perform in a timely manner in accordance with the Contract Documents and, through the fault of Contractor or Subcontractor(s), fails to achieve Substantial Completion within the Contract Time, Contractor shall be in default.

B. Actual Damages: If no liquidated damages are established, actual damages may be assessed for failure to achieve both Substantial Completion and 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 Substantial and/or Final Completion should have been achieved, as applicable. 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, and, where required, accepted shop drawings and other Submittals, 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, changes made to the building enclosure, and Change Order Proposals. This separate set of Drawings and Specifications shall be the “Project Record.” The Project Record shall include all Architectural, Mechanical, Electrical, Structural and Civil as-built drawings, whether or not any changes occur and shall also include Addenda, Change Orders, WDs and other modifications to the Contract, in good order and marked currently to indicate field changes and selections made during construction, as well as one copy of accepted shop drawings, product data, samples and other required Submittals.

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 available to A/E and Owner at all times. 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 SUBMITTALS

A. Definition of Submittals: “Submittals” 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. Submittals can 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 Submittals provided in accordance with the Contract Documents.

B. Approval of Submittals by Contractor and A/E: Contractor shall coordinate all Submittals with the Progress Schedule per Section 3.02A, shall 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, Submittals shall be stamped by an appropriate professional licensed by the state of Washington. Submittals submitted to A/E without evidence of Contractor’s approval shall be returned for resubmission. Contractor shall
review, approve, and submit Submittals 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 Submittals. Contractor shall perform no portion of the Work requiring submittal and review of Submittals 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 Submittal with reasonable promptness. Any Work by Contractor shall be in accordance with reviewed Submittals. Submittals made by Contractor which are not required by the Contract Documents may be returned without action.

C. Contractor not relieved of responsibility when Submittals approved: Approval, or other appropriate action with regard to Submittals, by Owner or A/E shall not relieve Contractor of responsibility for any errors or omissions in such Submittals, 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 Submittals and Contract Documents: Submittals, including product data, samples and similar submissions, are not Contract Documents. If Submittals vary from the requirements of the Contract Documents, Contractor shall describe such variations in writing, separate from the Submittals, at the time it submits the Submittals containing such variations. If Owner 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 approved by Owner in writing and recorded upon the Project Record. Approval for substitutions shall not be sought and shall not be approved through the submission of Submittals.

E. Contractor to submit 5 copies of Submittals: Unless otherwise provided in Division 1, Contractor shall submit to A/E for approval 5 copies of all Submittals. Unless otherwise indicated, 3 sets of all Submittals 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. 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 Submittals, together with the information and diagrams contained therein, prepared by Contractor or any Subcontractor. In providing Submittals, Contractor and all Subcontractors warrant that they have authority to grant to Owner a license to use the Submittals, 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 Submittals hereunder, or to secure for Owner, at Contractor's own cost, licenses in conformity with this section.

D. Submittals to be used only for this Project: 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 Submittals appropriate to and for use in the execution of their Work under the Contract Documents.

E. Electronic Files: If the parties intend to transmit the instruments of service or any other information or documentation in digital form (other than PDF), they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in 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 skillful 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: Contractor, as soon as practicable after award of the Contract, shall furnish in writing to Owner the name and qualifications of its proposed superintendent. Owner may reply within 14 Days to Contractor in writing stating (1) whether Owner has reasonable objection to the proposed superintendent or (2) that Owner requires additional time to review. Failure of Owner to reply within the 14-Day period shall constitute Notice of no reasonable objection. The superintendent shall not be employed on any other project during the course of the Work. Unless approved by the Owner’s representative and only when overseeing projects on the same campus or location where oversite and supervision will not be degraded. Performance of the Work shall be directly supervised by a competent superintendent who shall be in attendance at the Project site during performance of the Work and who has authority to act on behalf of Contractor. Communications given to the superintendent shall be as binding as if given to Contractor. The superintendent must be satisfactory to 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 Submittals, 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 secure and pay for the building, any land use permits and all other 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.

D. **Taxes:** Contractor shall pay sales, consumer, use, business and occupation, income and similar taxes for the Work that are legally enacted when the initial Contract Sum is agreed.

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 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.

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. Contractor shall be solely and completely responsible for conditions of the Project site, including safety of all persons and property, during performance of the Work. Contractor shall maintain the Project site and perform the Work in a manner that meets statutory and common-law requirements for the provision of a safe place to work. This requirement shall apply continuously and not be limited to working hours. Any review by Owner or A/E of Contractor’s performance shall not be construed to include a review of the adequacy of Contractor’s safety measures in, on or near the site 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 5.07 shall relieve Contractor of sole and complete responsibility for safety at the Project site, for sole and complete responsibility for any violation of safety or property protection requirements or the correction thereof, or impose any duty upon Owner or A/E with regard to, or as constituting any express or implied assumption of control or responsibility over, any other safety conditions relating to employees or agents of Contractor or any of its Subcontractors, or the public. Any Notice Owner or A/E gives to Contractor of a safety or property protection violation will not: (1) relieve Contractor of sole and complete responsibility for the violation and the correction thereof, or for sole liability for the consequences of said violation; (2) impose any obligation upon Owner or A/E to inspect or review Contractor’s safety program or precautions or to enforce Contractor’s compliance with the requirements of this Section 5.07; or (3) impose any continuing obligation upon Owner or A/E to provide such Notice to Contractor or any other persons or entity.

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: At all times until Owner’s occupancy of the Work or a designated portion of the Work, Contractor shall protect the Work from damage, weather, deterioration, theft, vandalism and malicious mischief and shall bear the risk of any uninsured loss or destruction of, or injury or damage to, all materials, equipment, tools, and other items incorporated or to be incorporated in the Work or designated portion, or consumed or used in the performance of the Work or designated portion, including all Work in process and completed Work. Contractor shall protect from damage all existing structures, equipment, improvements, utilities, streets, curbs, walks and vegetation at or near the Project site or 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. If a governmental authority having jurisdiction requires that the repairing and patching be done with its own labor and/or materials, Contractor shall abide by such regulations, and it shall pay for this work at no additional cost to Owner.

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.

C. **Special site conditions:** If, in the course of the Work, Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, Contractor shall immediately suspend any operations that would affect them and shall notify Owner and A/E. Upon receipt of such Notice, Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. Contractor shall continue to suspend these operations until otherwise instructed by Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Part 8.

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 and after submittal and approval of a substitute request, 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 complete the Work or 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 damage or endanger any work of Owner or separate contractors 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. Contractor shall restore all areas requiring cutting, fitting and patching to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

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. However, neither this authority of Owner nor a decision made either to exercise or not to exercise such authority shall give rise to a duty or responsibility of Owner or its representatives to Contractor, Subcontractors, their agents or employees, or other persons or entities performing portions of the Work.

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 request of Owner or the requirements in the Contract Documents or a governmental authority having jurisdiction, it must, if required in writing by Owner, be uncovered for Owner’s observation and be replaced at Contractor’s expense and without change in the Contract Sum or 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 correction and 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 Section 5.16D shall survive Final Acceptance and are in addition to other warranties provided by contract or law.

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. Owner shall help coordinate the activities of Owner’s own forces and of each separate contractor engaged by Owner with the Work of Contractor, who 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.

6. Meet all supplemental responsibility criteria set forth in the Contract Documents.

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 Owner has a “reasonable objection,” and shall obtain Owner’s written consent before making any substitutions or additions. A “reasonable objection” shall include without limitation:

   .1 a proposed Subcontractor differing from the entity listed with a proposal or bid,

   .2 lack of "responsibility" of the proposed Subcontractor, as defined in RCW 39.04.350 or otherwise in the Contract Documents, or

   .3 lack of qualification, including technical qualification, as required by the Specifications.

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, assign if requested, and furnish directly to Owner, all warranties that would be given in normal commercial practice or that are required by the Contract Documents, first executed by the applicable Subcontractor and those suppliers and manufacturers furnishing materials for the Work, and subsequently countersigned by Contractor, which shall extend to Owner all rights, claims, benefits and interests that Contractor may have under express or implied warranties or guarantees against the Subcontractor, supplier or manufacturer for defective or non-conforming Work;

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:** To the fullest extent permitted by law, Contractor shall defend, indemnify, and hold Owner and A/E, their consultants, and agents and employees, directors, officers, lenders, successors and assigns of any of them (collectively, the "Indemnified Parties"), harmless from and against all third-party 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, direct and indirect, or consequential (including but not limited to costs and attorneys' fees incurred on such claims or in proving the right to indemnification), arising out of, caused by or resulting from:

1. **Sole negligence of Contractor:** The sole negligence or willful misconduct of Contractor or any of its Subcontractors, their agents and anyone directly or indirectly employed by them or anyone for whose acts they may be liable ("Indemnitor");

2. **Concurrent negligence:** The concurrent negligence of Indemnitor, but only to the extent of the negligence of Indemnitor; and

3. **Patent infringement:** The use of any design, process, or equipment that constitutes an infringement of any United States patent presently issued, or violates any other proprietary interest, including copyright, trademark, and trade secret, unless specifically directed to use such design, process, or equipment by Owner.

The obligations of Contractor under this Section 5.22 shall not be construed to negate, abridge, or otherwise reduce any other right or obligations of indemnity that would otherwise exist as to any party or person described in this Section. To the extent the wording of this Section 5.22 would reduce or eliminate the insurance coverage of Owner or Contractor, this Section 5.22 shall be considered modified to the extent that such insurance coverage is not affected. To the extent that any portion of this Section 5.22 is stricken by a court or arbitrator for any reason, all remaining provisions shall retain their vitality and effect. The provisions of this Section 5.22 shall survive completion, acceptance, final payment and termination of the Contract.

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 Washington 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 allocate at least the percentage of the original Contract Sum so designated in the Contract Documents to that portion of the Work between Substantial Completion and Final Completion to recognize not-yet-earned costs for demobilization, Project Record, O&M manuals, and any other requirements for Project closeout and in advancing the Work from Substantial Completion to Final Completion. The approved Schedule of Values shall be used by Owner as a basis for reviewing 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 (using Owner's form) 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 Application for 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. Owner has the right to request written evidence from Contractor that Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by Owner to Contractor for subcontracted Work. Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Owner shall not have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

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. The submission of an Application for Payment constitutes a certification that the Work is current on 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 or otherwise approved by Owner;

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. A progress payment, or partial or entire use or occupancy of the Project by Owner, shall not constitute acceptance of Work.

**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 of Work**: Work by Owner to correct defective Work or complete the Work in accordance with Section 5.16;

4. **Third party claims for which Contractor may be responsible**: Claims (except where an insurer has unconditionally accepted coverage without prior payment of any deductibles or self-insured retentions) filed or reasonable evidence indicating probable filing of such claims unless Contractor provides security acceptable to Owner;

5. **Failure to pay Subcontractor**: The failure of Contractor to make payments to Subcontractors for labor, materials or equipment;

6. **Damages**: Damage to Owner or a separate contractor (except where an insurer has unconditionally accepted coverage);

7. **Affidavits of Wages Paid**: Failure to submit affidavits pertaining to wages paid as requested or otherwise required by statute;

8. **Progress Schedule**: Failure to submit a properly updated Progress Schedule;

9. **Maintenance of Project Record**: Failure to properly maintain as the Project Record;

10. **Other construction records**: Failure to properly submit any other required construction reports or records;

11. **Certified payrolls**: Failure to properly submit certified payrolls when requested;

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

13. **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, BOND CLAIM RIGHTS, AND LIENS

A. **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.
B. **Liens:** Contractor shall promptly pay (and secure the discharge of any liens asserted by) all persons properly furnishing labor, equipment, materials or other items in connection with the performance of the Work (including, but not limited to, any Subcontractors) to the extent that Owner has paid Contractor for this Work. Owner may, at its option, withhold payment, in whole or in part, to Contractor until lien and claim releases are furnished. Contractor may provide other security acceptable to Owner, such as a bond, in lieu of paying disputed liens or claims. Contractor shall defend, indemnify, and hold harmless Owner from any liens, including all expenses and attorneys’ fees, except to the extent a lien has been recorded because of a failure of payment by Owner for the Work implicated in any such lien.

### 6.07 SUBSTANTIAL COMPLETION

**A. 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, the Project has been constructed in substantial accordance with the Contract Documents, and at a minimum the following elements have been accomplished (see also, Section 01 70 00 Project Completion):

1. A written punch list has been prepared;
2. The Authority Having Jurisdiction has granted a certificate of occupancy; and
3. The first final draft of the Operation and Maintenance manuals has been submitted to Owner.

All Work other than incidental corrective or punch list work shall be completed. Substantial Completion shall not have been achieved if the Work cannot achieve Final Completion within the time specified in the Agreement. 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.

**B. Contractor to provide weekly reports before Substantial Completion:** Beginning at least 30 Days before the scheduled date of Substantial Completion, Contractor shall prepare reports weekly, identifying items to be completed in order to obtain necessary occupancy certificates and permits, and make recommendations to Owner for effectuating the earliest possible completion. When Contractor considers that the Work, or a portion thereof that Owner agrees to accept separately, has achieved Substantial Completion, Contractor shall prepare and submit to Owner a comprehensive list of items to be completed or corrected prior to final payment. Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on the list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents.

**C. Owner to determine if Work is complete:** Upon receipt of Contractor’s list, Owner will make an inspection to determine whether the Work or designated portion thereof has achieved Substantial Completion. If Owner’s inspection discloses any item, whether or not included on Contractor’s list, that is not sufficiently complete in accordance with the Contract Documents so that Owner can occupy or utilize the Work or designated portion thereof for its intended use, Contractor shall, before the occurrence of Substantial Completion, complete or correct the item upon notification by Owner, and Contractor shall then submit a request for another inspection by Owner to determine Substantial Completion. If Owner determines that the Work or designated portion has not achieved Substantial Completion, Contractor shall expeditiously complete the Work or
designated portion, again request an inspection, and pay the costs associated with the re-inspection.

D. **Owner may take over punch list:** If, at 30 Days after the date of Substantial Completion, Owner considers that the remaining items on its list (“punch list”) are unlikely to be completed within the time period specified in the Contract Documents for Final Completion, Owner may, upon seven Days’ written Notice to Contractor, take over and perform some or all of the punch list items. If Contractor fails to correct the deficiencies within the time period specified, Owner may deduct the actual cost of performing this punch list work, including any design costs, plus ten 10% to account for Owner’s transaction costs, from the Contract Sum.

E. **Owner to establish date of Substantial Completion:** When the Work or designated portion thereof has achieved Substantial Completion, Owner shall establish the date of Substantial Completion in writing, establish responsibilities of Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and fix the time within which Contractor shall finish all items on the list accompanying the document. The writing establishing Substantial Completion shall be submitted to Contractor for its written acceptance of the responsibilities assigned to it. Any items not included in the document but required or necessary for Final Completion of the Work shall be supplied and installed by Contractor as a part of the Contract Sum, notwithstanding their not being included in the punch list. Upon written acceptance of the writing establishing Substantial Completion by Contractor and Owner, and upon Contractor’s Application for Payment, Owner shall make payment as provided in the Contract Documents. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents. No further payment will be due or owing until the payment following Final Completion.

F. **Contractor to complete punch list in timely manner:** Contractor shall prepare, continue to monitor, and cause to be completed, all punch lists with respect to the activity of each Subcontractor and report weekly to Owner on outstanding punch list items.

### 6.08 PRIOR OCCUPANCY

A. **Prior Occupancy defined; Restrictions:** Owner may, when legally permissible to do so and upon written Notice 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, and Contractor shall cooperate with such occupancy and use and the establishment of a punch list. 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 of Substantial or Final Completion; 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 it constitute Final Acceptance, which is a subsequent, separate, and distinct action (see also, Section 01 70 00 Project Completion).
B. **Final Acceptance defined:** Unless otherwise determined by Owner, Final Acceptance shall be achieved after Contractor has completed all the requirements of the Contract Documents. The date Final Acceptance is achieved shall be established by Owner in writing. Pursuant to RCW 60.28, “Lien for Labor, Materials, Taxes on Public Works,” completion of the Contract Work shall occur upon Final Acceptance. 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 (see also, Section 01 70 00 Project Completion).

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 the Work:** Changes in the Work may be accomplished after execution of the Contract without invalidating the Contract. Changes in the Work that adjust the Contract Sum and/or Contract Time are incorporated into the Contract solely by Change Order and are subject to the limitations stated in this Part 7 and elsewhere in the Contract Documents. A Change Order may be bilateral or unilateral, as described below. Change Orders may be initiated by mutual agreement or through a Contract Change Proposal (“CCP”) or Work Directive (“WD”).

B. **Change Orders:**

1. A Bilateral Change Order is signed by Owner and Contractor to record their agreement on the terms of a change in the Work. A Bilateral Change Order may reflect the agreement of Owner and Contractor on a standalone issue, or it may incorporate one or more mutually agreed upon CCPs or WDs. A Bilateral Change Order shall constitute full payment and final settlement of all claims for time and cost, including direct, indirect, impact and consequential costs, related to the Change Order and Work covered by, affected by and related to the events giving rise to the Change Order.

2. A Unilateral Change Order is initially signed only by Owner to set forth, subject to the Contract, the terms of a change in the Work based upon one or more CCPs and/or WDs to which the parties have not yet fully agreed. Within 7 Days of its receipt of a Unilateral Change Order, Contractor shall notify Owner in writing either (a) of its acceptance of its terms, in which case the Unilateral Change Order will automatically become a Bilateral Change Order, or (b) of Contractor’s rejection, in which case Contractor must submit a written rejection within 14 Days after Contractor delivered written Notice of rejection to Owner as noted above. The written rejection must fully explain the reasons for rejecting the Unilateral Change Order and include all necessary supporting documentation. The rejection will then be considered in accordance with Section 8.02 (Informal Resolution of Disputes). Failure to submit a written Notice of rejection within 7 Days of Contractor’s receipt of a Unilateral Change Order or a written rejection with 14 Days shall constitute Contractor’s acceptance of the terms of the Unilateral Change Order.
C. Change Orders via Contract Change Proposal:

1. Contractor shall be responsible for maintaining an Issues Log. If Contractor at any time believes that a change in the Work has or may have occurred, Contractor shall add such item to the Issues Log. At a minimum, the Issues Log shall identify:
   a. Detailed scope of the change in the Work;
   b. Contract Time impact noting specifically how it impacted the critical path of the project, if any;
   c. The amount of any anticipated, proposed, or approved change in the Contract Sum;
   d. Date first included on the Issues Log;
   e. Owner-initiated or Contractor-initiated; and
   f. Action status.

2. If the Contractor believes an item on the Issues Log warrants a CCP, Contractor shall provide written Notice to Owner in accordance with Section 8.02, and shall submit a written CCP in accordance with this Section. All CCPs shall be substantiated and submitted within 7 Days of being added to the Issues Log along with a revised progress schedule identifying the time impact affecting the critical path, if any. The CCP shall identify the proposed full compensation for implementing the proposed change in the Work, including any adjustment in the Contract Sum or Contract Time. Upon receipt of the CCP, Owner may accept the proposal and incorporate it into a Bilateral Change Order, reject the proposal and either issue a WD or elect not to proceed with the proposal, request further documentation, or negotiate acceptable terms with Contractor.

D. Work Directives:

1. A WD is a written order prepared by Owner that directs Contractor to perform Work prior to total agreement on an adjustment, if any, in the Contract Sum and/or Contract Time. Owner may direct Contractor, at any time and without invalidating the Contract, through a WD to proceed with a change in the Work or to perform Work that Contractor contends to be a change in the Work, with or without the agreement of Contractor and prior to agreement of the basis for adjustment, if any, to the Contract. Owner’s use of a WD does not constitute agreement that the directive constitutes a change in the Work, the Contract Sum or the Contract Time.

2. A WD normally includes:
   a. The scope of the directed Work,
   b. Any proposed adjustment to the Contract Sum or not-to-exceed amount,
   c. Any proposed change to the Contract Time,
   d. The proposed method of determining any change in the Contract Sum and/or Contract Time, and
e. The supporting data that Contractor must submit in accordance with the requirements of Part 7 of the General Conditions.

3. Upon receipt of a WD, Contractor shall promptly commence and proceed diligently with performance of the directed Work. Within 7 Days of its receipt of a WD, Contractor shall notify Owner in writing either (a) of its acceptance of its terms, in which case the terms will become effective, and the WD will be incorporated into a Bilateral Change Order, or (b) of Contractor’s rejection of the terms, in which case Contractor must submit a written rejection within 14 Days after Contractor delivered written Notice to Owner as noted above. The written rejection must fully explain the reasons for rejecting the WD and include all necessary supporting documentation. The rejection will then be considered in accordance with Section 8.02. Contractor’s rejection of a WD shall not relieve Contractor of its obligation to comply promptly with the WD.

E. Contractor fault or negligence alleged as basis for change in Contract Sum: 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; or to the extent Contractor is responsible for change concurrently caused by Contractor and Owner; or to the extent the change is caused by an act of Force Majeure as defined in Section 3.05.

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.

2. Allowances: Any Allowances stated in the Contract Documents shall be included in the Contract Sum. Items covered by Allowances shall be supplied for such amounts and by such persons or entities as Owner may direct, but Contractor shall not be required to employ persons or entities to whom Contractor has made reasonable and timely objection. Owner shall select materials and equipment under an Allowance with reasonable promptness. Allowances shall cover the net cost to Contractor of materials and equipment delivered and/or installed at the site, as identified in the Allowance, and all required taxes, less applicable trade discounts. Whenever actual costs are more than or less than Allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect the difference between actual, reasonable costs and the Allowances.

3. Pricing Components: Contractor shall maintain and submit a complete itemization of the costs incurred as a result of any change in the Work, including labor, material, Subcontractor costs, and fee. The total cost of any change in the Work or of any other increase or decrease in the Contract Sum, including a Claim, shall be limited to the actual, reasonable amounts for the following components, itemized in the manner set forth below and submitted on breakdown sheets in a form approved by Owner. If the total cost of the change in the Work does not exceed $5,000.00, Contractor shall not be required to submit a breakdown if the description of the change in the Work is sufficiently definitive for Owner to determine fair value.

a. Labor costs: The labor cost component is determined by multiplying the estimated or actual additional number of hours needed to perform the change in the Work by the fully burdened hourly labor costs. The fully burdened hourly costs shall include 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” shall be applicable unless a high, documented amount is actually paid by a contractor for the laborers, apprentices, journeymen, foremen, and other staff performing and/or directly supervising the change in the Work at the site. Any amount in excess of approved “Statement of Intent to Pay Prevailing Wages” shall be substantiated and subject to audit.

(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) Supervision: The labor cost component may include the actual, demonstrated additional supervision hours (not already compensated by Owner) directly related to a change in the Work.

(5) Travel and Per Diem allowance: Travel allowance and/or subsistence, if applicable, required by regional labor union agreements, which are itemized and identified separately.

b. Material costs: The material cost component must be itemized and include material invoices or reasonable lump-sum estimates of the quantity and cost of additional materials needed to perform the change in the Work. Material costs shall be developed first from actual known costs; second from supplier quotations; and, if neither of these is available, then from standard industry pricing guides acceptable to Owner. Material costs shall consider all available discounts. Freight costs, express charges, or special delivery charges shall be itemized.

c. Equipment costs: The equipment cost component must be itemized by the type of equipment and include 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 on site. Costs will be allowed for construction equipment only to the extent used solely for the changed Work, or for additional rental costs actually incurred by Contractor solely for the changed Work. Equipment charges shall be computed on the basis of actual invoice costs or, if owned, from the current edition of the Associated General Contractors Washington State Department of Transportation (AGC WSDOT) Equipment Rental Agreement current edition as of the Contract execution date. The EquipmentWatch Rental Rate Blue Book shall be used as a basis for establishing rental rates of equipment not listed in the above source. The maximum rate for standby equipment shall not exceed that shown in the AGC WSDOT Equipment Rental Agreement. The rate for Contractor-owned equipment necessarily standing by for future use on the changed Work shall be no more than 50% of the rate established above unless otherwise approved by Owner. The total rental cost shall not exceed the cost of purchasing the equipment outright.

d. Subcontractor costs: The Subcontractor cost component consists of payments Contractor makes to Subcontractors for the cost of changed Work performed by
Subcontractors. Subcontractors’ costs shall be calculated and itemized in the same manner as prescribed herein for Contractor.

e. Fee: The Fee component is compensation for all items and costs not listed in subparagraphs a through d above, and is added to the total cost to Owner of the sum of these items. The Fee shall compensate Contractor, Subcontractor and suppliers for, among other things, combined overhead, profit and other costs, including all office, home office and site overhead, employee per diem, subsistence and travel costs not separately reimbursable under subparagraph a above, warranty, safety costs, printing and copying, quality control/assurance, purchasing, small or hand tool (a tool that costs $250 or less and is normally furnished by the performing contractor) or expendable charges, temporary construction facilities, field engineering, schedule updating, Project Record, home office cost, taxes (including all taxes except B&O tax and Washington State sales tax payable based on the amount of the approved Application for Payment), office engineering, estimating costs, additional overhead because of extended time, Claim and change preparation, direct and indirect delay, acceleration or impact, and any other cost incidental to the change in the Work. The Fee shall be strictly limited in all cases to the rates below.

(1). Contractor markup on Contractor Work: Contractor is allowed a Fee for any Work actually performed by Contractor’s own forces of 16% of the first $50,000 of the cost of such Work and 4% of the remaining cost, if any.

(2). Subcontractor markup for Subcontractor Work: Each Subcontractor (including lower-tier Subcontractors) is allowed a Fee for any Work actually performed by its own forces of 16% of the first $50,000 of the cost of such Work and 4% of the remaining cost, if any.

(3). Contractor markup for Subcontractor Work: Contractor is allowed a Fee for any Work performed by its Subcontractor(s) of 6% of the first $50,000 of the amount due each Subcontractor for such Work and 4% of the remaining amount, if any.

(4). Subcontractor markup for lower-tier Subcontractor Work: Each Subcontractor is allowed a Fee for any Work performed by its Subcontractor(s) of any lower-tier of 4% of the first $50,000 of the amount due the lower-tier Subcontractor for such Work and 2% of the remaining amount, if any.

(5). Basis of cost applicable for markup: The cost of the Work to which the Fee is to be applied shall be based on the cost components in subparagraphs 7.02.A 3.a – d.

(6). Application of Fee: The Fee shall not be included on deductive changes in the Work. Where a change in the Work involves additive and deductive work by Contractor or the same Subcontractor, the Fee as well as bond and insurance markups will apply to the net difference.

f. Insurance and bond premiums: The cost of any change in insurance or bond premium is added to the sum of the cost components in subparagraphs 7.02.A 3.a – e and is limited to the following:
(1) Contractor’s liability insurance: The cost of any changes in Contractor’s contractually required liability insurance arising directly from the Change Order; and

(2) Payment and Performance Bond: The cost of any additional premium for Contractor’s contractually required bond arising directly from the Change Order.

g. Tax: Washington State sales tax and B&O tax arising directly from the Change Order shall be added to the cost of the Change Order.

h. Unit Prices: If Unit Prices, including pre-agreed rates for material quantities, are applicable to a change in the Work, the Unit Prices shall be applied to the quantities of the items involved as determined in Section 7.02A. Quantities must be supported by field measurement statements signed by Owner. Owner shall be afforded access and be permitted to measure quantities. Contractor shall not exceed any cost limit(s) without Owner’s prior written approval. Unit Prices shall include reimbursement for all direct and indirect costs of the Work, but exclude Fee (7.02 A.e), bond, and insurance costs (7.02 A.f.).s.

7.03 CHANGE IN THE CONTRACT TIME

A. Changes in Contract Time: The Contract Time shall only be changed by a Change Order.

B. Time extension permitted only if delay is not Contractor’s fault: If Contractor is delayed at any time in the commencement or progress of the Work (1) by an act or neglect of Owner or anyone for whose acts Owner is responsible; or (2) by changes ordered by Owner in the Work; or (3) by Force Majeure; or (4) by delay authorized by Owner pending dispute resolution; or (5) by other causes that Owner determines may justify delay, then Contractor shall reasonably attempt to mitigate the delay, and the Contract Time shall be extended by Change Order for such reasonable time as Owner may reasonably determine consistent with the provisions of the Contract Documents. 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.

C. Contractor must demonstrate impact on critical path of schedule: Any change in the Contract Time covered by a Change Order or Claim shall be limited to the change in the critical path of the Work attributable to the change or event(s) giving rise to the Change Order or Claim. 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 in accordance with Section 01 32 13 Project Schedule.

D. Cost arising from change in Contract Time: Contractor is entitled to compensation for the cost of a change in Contract Time only if all the following conditions are met:

1. Must be solely fault of Owner: The change in Contract Time must solely be caused by the fault or negligence of Owner or others for whom Owner is responsible;

2. Procedures: Contractor must follow the procedure set forth in Section 7.03B and Section 8.02;

3. Demonstrate impact on critical path: Contractor must establish the extent of the change in Contract Time in accordance with Section 7.03C and Section 01 32 13 Project Schedule.
Schedule. Owner is not obligated directly or indirectly for damages or an increase in the Contract Sum for any delay suffered by a Subcontractor that does not increase the Contract Time; and

4. Cost measured exclusively by the pricing components of Section 7.02A.3: If Contractor or a Subcontractor of any tier is entitled to compensation arising from or related to a change in Contract Time, the pricing components of Section 7.02A.3 shall exclusively be used to measure the actual costs incurred as a result of the change in Contract Time. Neither Contractor nor a Subcontractor of any tier is entitled to payment for costs arising out of actual or alleged loss of efficiency; morale, fatigue, attitude, or labor rhythm; home office overhead; expectant underrun; trade stacking; reassignment of workers; rescheduling of work; concurrent operations; dilution of supervision; learning curve; beneficial or joint occupancy; logistics; ripple; season change; extended overhead; profit upon damages for delay; impact damages, including cumulative impact; or similar damages.

PART 8 - CLAIMS AND DISPUTE RESOLUTION

8.01 CLAIMS

A. Definition: A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of the Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract Documents. The term “Claim” also includes other disputes and matters in question between Owner and Contractor arising out of or relating to the Contract Documents. Claims must be initiated in writing and be made in accordance with the Contract Documents. Neither a CCP, a Request for Information, a Bilateral or Unilateral Change Order, a reservation of rights, minutes of a meeting, a daily report, or a log entry shall constitute a Claim or Notice of a Claim. However, Owner and Contractor may agree in a signed writing to supplement how Contractor can provide a Notice of Claim as specified in this Part 8.

B. Continuing Contract performance: Pending final resolution of a Claim, including the dispute resolution process in Part 8, and except as otherwise agreed in writing or in the Contract Documents, Contractor shall proceed diligently with performance of the Work and maintain the Progress Schedule, and Owner shall continue to make payments of undisputed amounts in accordance with the Contract Documents.

C. Claims for additional cost: If Contractor wishes to make a Claim for an increase in the Contract Sum, written Notice as provided herein shall be given before proceeding to execute the Work, and written Notice and a written Claim must be made in accordance with this Part 8, or it will be waived.

D. Claims for additional time: If Contractor wishes to make a Claim for an increase in the Contract Time, written Notice as provided herein shall be given, and a written Claim must be made in accordance with this Part 8, or it will be waived.

E. Claims for consequential damages: Contractor and Owner waive certain Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes damages incurred by Owner for profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and damages incurred by Contractor for principal and home office overhead and expenses including but not limited to the compensation of personnel stationed there, for loss of financing, business and/or reputation, for losses on other projects, for loss of profit, and for interest or financing costs. This mutual waiver is applicable, without limitation, to all consequential damages due to either party’s termination. Nothing contained in this subparagraph E, however, shall be deemed to preclude an
award of liquidated or other delay damages, when applicable, in accordance with the Contract Documents, or to preclude or limit Contractor’s obligation to procure and maintain the insurance policies required by this Contract or indemnify Owner for damages, including direct, indirect or consequential damages, alleged by a third party.

8.02 INFORMAL RESOLUTION OF DISPUTES

A. Procedure to reduce disputes: In an effort to reduce the incidence and cost to all parties of extended disputes, all disputes, direct or indirect, arising out of or relating to the Contract Documents or the breach thereof, except those that have been waived under the terms of the Contract Documents, shall be decided exclusively by the dispute resolution procedure of Part 8 unless the parties mutually agree in writing otherwise. To the extent that Owner and Contractor agree to a partnering or dispute review process to help address disputes, these processes shall be in addition to, and not in place of, the mandatory contractual dispute resolution procedures.

B. Notice: Except for disputes requiring Notice before proceeding with the affected Work as otherwise described in the Contract Documents, Contractor shall submit a written Notice of any Claim to Owner's Project Manager, consistent with the requirements of the Contract Documents, within 7 Days of the occurrence of the event giving rise to a dispute. If Contractor did not have actual knowledge of such an event, the written Notice shall be submitted within 7 Days of the date that Contractor reasonably should have been aware of the event. The Notice shall set forth, at a minimum, a description of the event(s) leading to or causing the dispute, the nature of the impacts to Contractor and its Subcontractors, if any, and an estimate of any claimed adjustments in the Contract Sum and/or Contract Time. Without waiving any rights, Owner and Contractor may discuss and attempt to resolve a dispute identified in a Notice of Claim directly with each other or with a third-party neutral or dispute review board if utilized on a Project.

C. Substantiation: If an issue remains unresolved, Contractor shall submit timely written substantiation to support Contractor’s position relating to the Notice of Claim. Such substantiation, which shall include an explanation of Contractor's position and any supporting documentation, shall be provided within 30 Days of submitting a Notice. Contractor may delay submitting data by an additional 14 Days if it notifies Owner that substantial data must be assembled.

D. Owner’s Project Manager to make initial decision on all disputes: After Contractor has submitted written substantiation to Owner that complies with all applicable provisions of Parts 7 and 8, as well as Section 01 32 13, Project Schedule, Owner’s Project Manager will endeavor to respond, in writing, to Contractor within 7 Days of the date substantiation is received, or with Notice to Contractor of the date by which Owner’s Project Manager expects to render a decision. If necessary to fully and fairly evaluate an issue, the Project Manager may request additional information or extend the time in which to respond. If the issue is not resolved, or if Project Manager does not respond within the later of 7 Days of the date written substantiation is received or the date specified for rendering a decision, the dispute may be escalated by Contractor to Owner's Assistant Vice President, Facilities Services, Capital as set forth in Section 8.02E below.

E. Contractor may respond to initial decision: The initial decision of the Project Manager will be final and conclusive unless, within 7 Days of the date Contractor receives the initial decision or the date specified for rendering a decision, Contractor notifies Owner's Project Manager in writing of Contractor’s disagreement with the initial decision, in which case Contractor must then submit a written rejection to Owner’s Assistant Vice President, Facilities Services, Capital within 14 Days. The written rejection must attach the submitted Notice and substantiation and fully explain the reasons for Contractor’s disagreement with the initial decision. It must also include all applicable supporting documentation. Failure to submit a written rejection to Owner’s Assistant Vice
President, Facilities Services, Capital within 14 Days shall constitute Contractor's acceptance of the initial decision.

F. Assistant Vice President, Facilities Services, Capital decision: Following Contractor's full compliance with the procedure above, Owner's Assistant Vice President, Facilities Services, Capital will endeavor to respond in writing to Contractor with a decision within 7 Days of delivery of the Contractor's rejection or with Notice to Contractor of the date by which Owner's Assistant Vice President, Facilities Services, Capital expects to render a decision. If Owner's Assistant Vice President, Facilities Services, Capital does not respond within the later of 7 Days after delivery of the rejection or the date specified to render a decision, the dispute will be deemed denied and Contractor may further escalate the dispute as set forth in Section 8.02G below.

G. Claim: If Contractor disagrees with the decision of the Assistant Vice President, Facilities Services, Capital, or if no decision is timely received, Contractor shall timely submit a Claim if it wishes to pursue formal dispute resolution or seek additional relief against Owner of any kind. A Claim must be consistent with the Notice, substantiation and rejection previously provided, be submitted to Owner in writing within 14 Days of the date the decision of the Assistant Vice President, Facilities Services, Capital is received by Contractor or due, and comply with Section 8.04. Any claim of a Subcontractor of any tier may be brought only through, and after review by, Contractor. Contractor acknowledges and agrees that no additional documentation from what was submitted to Owner's Assistant Vice President, Facilities Services, Capital (per part 'F' of this section) may be submitted and considered in any subsequent dispute resolution proceeding. Contractor's failure to provide timely information for Owner's consideration during the dispute resolution procedure of Part 8 has a substantial impact upon and prejudices Owner, including but not limited to its inability to fully investigate or verify a Claim, mitigate damages, choose alternative options, adjust the budget, delete or modify the impacted Work, and/or monitor time, cost and quantities.

8.03 FORMAL RESOLUTION OF CLAIMS

A. Option for direct discussions: At any time following Contractor's initiation of formal dispute resolution, Owner may require that an officer of Contractor and Owner's Assistant Vice President, Facilities Services, Capital (all with authority to settle) meet, confer, and attempt to resolve the Claim. If the Claim is not resolved during such meeting, or if no such meeting is requested, Contractor may bring no litigation against Owner unless Contractor complies with the procedures described in Sections 8.03B and C. This requirement cannot be waived except by an explicit written waiver signed by Owner and Contractor.

B. Mediation:

1. Mediation required: Claims, disputes, or other matters in controversy arising out of or related to the Contract shall be subject to mediation as a condition precedent to the initiation of binding dispute resolution. This requirement cannot be waived except by an explicit written waiver signed by both Owner and Contractor. Unless Owner and Contractor mutually agree in writing otherwise, all unresolved Claims shall be considered at a single mediation session that shall occur after Substantial Completion and prior to Final Acceptance by Owner.

2. Mediation procedure: The parties shall endeavor to resolve Claims by mediation. A request for mediation shall be delivered in writing to the other party to the Contract, and the parties shall promptly attempt to mutually agree on a mediator. If the parties do not agree on a mediator within 30 Days of a party's demand, the mediation, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect.
on the date of the Agreement. Mediation shall proceed in advance of binding dispute resolution proceedings.

3. **Mediation fee to be shared:** The parties to the mediation shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction.

4. **Representatives with authority must attend mediation:** Representatives of Contractor and Owner must attend the mediation session in person with authority to settle the Claim. To the extent there are other parties in interest, such as A/E, insurers or Subcontractors, their representatives, also with authority to settle the Claim, shall also attend the mediation session in person.

C. **Litigation:** Contractor may bring no litigation on a Claim unless the Claim has been raised and considered in accordance with the procedures of this Part 8, including mandatory mediation. Contractor shall have the burden to demonstrate in any litigation that it has complied with all requirements of this Part 8. All unresolved Claims of Contractor shall be waived and released unless Contractor has complied with the time limits of the Contract Documents, and litigation is served and filed within 180 Days after the Date of Substantial Completion approved in writing by Owner. This requirement cannot be waived except by an explicit, written waiver signed by Owner and Contractor. The pendency of a mediation, which shall mean the time period between a party's receipt of a written mediation demand and the date of the initial mediation session, shall stay this deadline for serving and filing a lawsuit. The deadline may also be stayed for an additional period by agreement of the parties or court order. Neither Contractor nor a Subcontractor, whether claiming under a bond or lien statute or otherwise, shall be entitled to attorneys’ fees directly or indirectly from Owner (but may recover attorneys’ fees from the bond or statutory retainage fund itself to the extent allowable under law).

### 8.04 CLAIMS PROCESS

A. **Notice and Claims:** Any Notice and any Claim of Contractor, whether under the Contract or otherwise, must be made pursuant to and in strict accordance with the applicable provisions of the Contract Documents. No act, omission, or knowledge, actual or constructive, of Owner or anyone for whose acts Owner is responsible shall in any way be deemed to be a waiver of the requirement for timely written Notice and a timely written Claim unless Owner and Contractor sign an explicit, unequivocal written waiver. The fact that Owner and Contractor may consider, discuss, or negotiate a Claim that has or may have been procedurally or substantively defective or untimely under the Contract shall not constitute a waiver of the provisions of the Contract Documents unless Owner and Contractor sign an explicit, unequivocal written waiver. Contractor acknowledges and agrees that Contractor's failure to timely submit required Notices and/or timely submit Claims has a substantial impact upon and prejudices Owner, including but not limited to its inability to fully investigate or verify the Claim, mitigate damages, choose alternative options, adjust the budget, delete or modify the impacted Work, and/or monitor time, cost and quantities.

B. **Claim must cover all costs and be documented:** A Claim shall be deemed to cover all changes in cost and time (including direct, indirect, impact, and consequential) to which Contractor (and Subcontractors) may be entitled and may not contain reservations of rights without Owner's written approval; any such unapproved reservations of rights shall be without effect. Any requests by Contractor for an adjustment in both the Contract Sum and Contract Time that arise out of the same event(s) shall be submitted together. A Claim must be fully substantiated and documented. At a minimum, a Claim shall contain the following information:
1. **Factual statement of Claim**: A detailed factual statement of the Claim for additional compensation and/or time, if any, providing all necessary dates, locations, and items of Work affected by the Claim, 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;

2. **Dates**: The date on which event(s) arose which gave rise to the Claim;

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

4. **Support from Contract Documents**: The specific provisions of the Contract Documents that 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**: Data and copies of any identified documents, other than the Contract Documents, that support the Claim, including without limitation a complete explanation as to why the relief sought is not within the scope of the Contract Documents;

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 showing cause and analysis of the resultant delay to the critical path and other information required by the Contract Documents and Section 01 32 13, Project Schedule;

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 and with the detail required by Section 7.02; and

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 responsible.

C. **False Claims**: Contractor shall not make any negligent or fraudulent misrepresentations, concealments, errors, omissions, or inducements to Owner in the formation or performance of this Contract. If Contractor or a Subcontractor submits false or frivolous substantiation or a Claim to Owner, which for purposes of this Section 8.01C is defined as substantiation or a Claim based in whole or in part upon a materially incorrect fact, statement, representation, assertion, or record, Owner shall be entitled to collect from Contractor by offset or otherwise (without prejudice to any right or remedy of Owner) any and all costs and expenses, including investigation and consultant costs, incurred by Owner in investigating, responding to, and defending against such false or frivolous substantiation or Claim.

D. **Notification of surety**: Owner may, but is not obligated to, notify Contractor’s surety, if any, of the nature and amount of any claim it may assert against Contractor. If the claim relates to a possibility of Contractor’s default, Owner may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy.
E. **Liens:** If a Claim relates to or is the subject of a lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice and filing deadlines.

F. **All Claims must be submitted for final resolution within the time period specified by applicable law:** Owner and Contractor shall commence all Claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of this Part 8 and within the time period specified by applicable law.

G. **Waiver of rights:** Any Claim of Contractor against Owner shall be conclusively deemed to have been waived by Contractor unless made in accordance with the requirements of Part 8.

H. **Owner may investigate:** To assist in the review of a Claim, Owner may at any time visit the Project site, communicate directly with Subcontractors, or request additional information (including requesting an audit as authorized below) in order to fully evaluate the issues raised by the Claim.

I. **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 permit Owner access to the books and records of Contractor or Subcontractors of any tier, or to maintain and retain sufficient records to allow Owner to verify all or a portion of the Claim, shall constitute a waiver of the Claim and shall bar any recovery.

J. **Contractor to make documents promptly available:** In support of Owner’s audit of any Claim, Contractor and any Subcontractor shall, upon request, promptly make available to Owner within seven Days of Owner’s request, at the office of Contractor or any requested Subcontractor during normal business hours, at least the following documents and other documents requested by Owner; failure to fully comply with this requirement shall constitute a material breach of contract and waiver of any Claim:

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.);
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 reports, including job cost summary and job cost detail reports, related labor and equipment reports, and 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 during performance of the Work. In addition, 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 non-privileged documents which relate to each and every Claim together with all documents which support the amount of any adjustment in the Contract Sum or Contract Time sought by each Claim;

23. Work sheets or software used to prepare and establish the cost components for items of the Claim, including but not limited to labor, benefits and insurance, materials, equipment, Subcontractors, all documents that establish the time periods, individuals involved, the hours for the individuals, and the rates for the individuals;

24. Work sheets, software, and all other documents used by Contractor to prepare its bid;

25. The above items for its Subcontractors; and

26. Any other information in any form or media not expressly protected from discovery by applicable law.

K. Contractor to cooperate and provide facilities for audit: The audit may be performed by employees or representatives 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.

L. Reciprocal RCW 42.56 rights: Contractor agrees, on behalf of itself and Subcontractors, that any invocation of RCW 42.56 at any time by Contractor or a Subcontractor, or their respective representatives, shall initiate an equivalent right to disclosures from Contractor and Subcontractors for the benefit of Owner. Failure to fully comply with these requirements shall constitute a material breach of the Contract and shall constitute a waiver of all Claims by Contractor and any Subcontractor that does not fully comply.
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: Contractor shall not be entitled to receive further payment until the Work is finished. 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.
9.03 TERMINATION BY CONTRACTOR FOR CAUSE

A. Contractor termination: Except as provided by RCW 60.28.080, Contractor may terminate the Contract for any of the following reasons:

1. Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped permanently;

2. An act of government, such as a declaration of national emergency, that requires all Work to be stopped permanently;

3. Because Owner has improperly not made payment of undisputed amounts within the time stated in the Contract Documents; or

4. The Work is stopped for a period of 60 consecutive Days through no act or fault of Contractor, a Subcontractor, or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with Contractor,

B. Contractor termination procedure: If one of these reasons exists, Contractor may, upon seven Days' written Notice to Owner (during which period Owner has the opportunity to cure), terminate the Contract and recover from Owner payment for Work executed in accordance with the Contract Documents, including reasonable overhead and profit on Work executed and costs incurred by reason of such termination. The total recovery of Contractor shall not exceed the unpaid balance of the Contract Sum.

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 internal laws of the state of Washington, without regard to its choice-of-law provisions. Venue shall be in the county in which the Project 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 the 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 Contract 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 an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations set forth in the Contract Documents. If a majority of the ownership or the control of Contractor is acquired by a third party, and such acquisition reasonably imperils performance or creates a conflict of interest that Owner, in its sole discretion, cannot reasonably reconcile, then Owner may terminate this Contract at any time for cause under Section 9.01.

10.03 MEANING OF WORDS

Meaning of words used in Contract Documents: Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings. 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 is 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 the 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 items as are shown on the Drawings, or required to complete the installation.

10.04 RIGHTS AND REMEDIES

A. **No waiver of rights:** Waiver of any provisions of the Contract Documents must be in writing and authorized by Owner. No other waiver is valid on behalf of Owner. No action, delay in acting, or failure to act by Owner or A/E shall constitute a waiver of a right or duty afforded under the Contract Documents, nor shall action, delay in acting, or failure to act constitute approval or an acquiescence in a breach therein, or otherwise prejudice the right of Owner to enforce a right or remedy at any subsequent time, except as may be specifically agreed in writing.

B. **Rights under Contract do not limit other rights:** Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

C. **If portion of Contract is void, remainder is enforceable:** If any portion of this Contract is held to be void or unenforceable, the remainder of the Contract shall be enforceable without such portion.

10.05 CONTRACTOR REGISTRATION AND COMPLIANCE

A. **Contractor must be registered and licensed:** Pursuant to RCW 39.06, Contractor shall be registered and licensed as required by the laws of the State of Washington, including but not limited to RCW 18.27. Contractor shall also have a current state unified business identifier number; have industrial insurance coverage for Contractor’s employees working in Washington as required in Title 51 RCW; have an employment security department number as required in Title 50 RCW; have a state excise tax registration number as required in Title 82 RCW; and not be disqualified from bidding on any public works contract under RCW 39.06.010 (unregistered or unlicensed contractors) or RCW 39.12.065(3) (prevailing wage violations).

B. **Employer contributions:** Pursuant to RCW 50.24, “Contributions by Employers,” in general and RCW 50.24.130 in particular, Contractor shall pay contributions for wages for personal services performed under this Contract or arrange for a bond acceptable to the Commissioner.

C. **Apprenticeship requirements:** If the Contract Sum for the Project exceeds one million dollars, Contractor shall comply with all applicable apprenticeship requirements.

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.

10.11 INDEPENDENT CONTRACTOR

Contractor is independent contractor: Contractor shall be and operate as an independent contractor in the performance of the Work and shall have complete control over and responsibility for all personnel performing the Work. Contractor is not authorized to enter into any agreements or undertakings for or on behalf of Owner or to act as or be an agent or employee of Owner.

10.12 OWNER’S ROLE

Owner’s role is limited. Owner will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely Contractor’s responsibility under the Contract Documents. The presence of Owner at the Project site shall not in any manner be construed as assurance that the Work is being completed in compliance with the Contract Documents, nor as evidence that any requirement of the Contract Documents of any kind, including Notice, has been met or waived. Owner will not be responsible for Contractor’s failure to perform the Work in accordance with the requirements of the Contract Documents. Owner will not have control over or charge of and will not be responsible for acts or omissions of Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.
Washington State University
Agricultural Research and Technology Building

GEOTECHNICAL INVESTIGATION REPORT

Design Development Outline Specification
November 2004
DRAFT

GEOTECHNICAL INVESTIGATION

PROPOSED WSU MOUNT VERNON EXPANSION

MOUNT VERNON, WASHINGTON

Submitted to:

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March 5, 2004 033-1040
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1.0 PROJECT AND SITE DESCRIPTION

Golder Associates Inc. (GAI) is pleased to present the results of our geotechnical engineering study for the proposed WSU Mount Vernon project. This project was completed in accordance with our proposal dated December 2, 2003.

The project site is located at the south side of State Route 536 in Mount Vernon, Washington (Figure 1). The project will consist of the construction of several additional structures at the Washington State University Mount Vernon Branch. The locations for the three proposed borings were provided to us by KPFF Consulting Engineers.

The purpose of the study was to investigate the subsurface conditions at the site and develop geotechnical design recommendations for the proposed structures. Specific design issues addressed in this report include:

- Subsurface soil and groundwater conditions at the site;
- Foundation support options and design recommendations;
- Retaining wall design criteria;
- Liquefaction assessment;
- Pavement design recommendations;
- Earthworks and construction related considerations.
2.0 INVESTIGATION PROCEDURES

A field investigation was completed between January 8th and 9th, 2004. The field investigation consisted of drilling one borehole to a depth of 99 feet below the existing ground surface and completing two cone penetration tests (CPT) to depths of 83.66 and 87.60 feet below the existing ground surface, in order to characterize the subsurface conditions. The boring and CPT locations are shown on Figure 2. In addition, laboratory classification testing was performed on selected borehole samples.

The drilling investigation was conducted using a truck-mounted Mobile B-59 drill turning 4.25-inch diameter (inside), hollow-stem, continuous flight augers. Water was maintained in the borehole during drilling to help prevent sample disturbance when sampling loose cohesionless deposits. Representative Standard Penetration Test (SPT) disturbed soil samples were obtained at 5 foot to 10 foot intervals. The samples were obtained in accordance with ASTM D-1586 "Penetration Test and Split Barrel Sampling of Soils". The test and sampling methods consist of driving a split spoon sampler a distance of 18 inches into undisturbed soils. The number of blows required to drive the sampler the final 12 inches is considered the Standard Penetration Resistance (N), which provides an indication of the relative density of granular soils and the relative consistency of cohesive soils. Field judgment is required when assigning density descriptions to soils containing a high percentage of coarse gravel and cobbles. In addition, Shelby samples were attempted in areas where cohesive soils were observed. All soil samples were placed in sealed sample jars to prevent moisture loss during transport to our Redmond, Washington laboratory.

The boring was monitored by an engineering geologist from our firm who located specific exploration locations, examined and classified the materials encountered, obtained representative samples, and recorded pertinent information including soil depths, stratigraphy, soil engineering characteristics, and groundwater levels. Representative soil samples were classified in accordance with Golder Associates Technical Procedures and the Unified Soil Classification System as described in Appendix A.

The results of twelve moisture content tests and two Atterberg Limits tests are provided on the borehole record in Appendix A. The ground surface elevation shown on the Borehole Record was estimated.

The cone penetration test results are presented in Appendix B. The measured data recorded in the field (i.e. tip resistance corrected for end area effects (Qt), porewater pressure (PWP), and sleeve friction resistance) and two interpreted parameters of classification index (Is) and SPT blow counts corrected for energy and depth (N160) are included on the sheets in Appendix B.
3.0 SUBSURFACE CONDITIONS

3.1 Geologic Setting

The recent geologic history of the Puget Sound Lowland region has been dominated by several glacial episodes. The most recent, the Vashon stage of the Fraser glaciation is responsible for most of the present day geologic and topographic conditions. The Puget lobe of the Cordilleran ice sheet deposited a heterogeneous assemblage of proglacial lacustrine deposits, advance outwash, lodgment till, and recessional outwash upon either bedrock or older pre-Vashon sediments and bedrock. As the glacier retreated northward, it uncovered a sculpted landscape of elongate uplands and intervening valleys. Post glacial deposits include: alluvium deposited within active stream channels, modern lacustrine deposits, organic silt and local peat deposits within kettle depressions, drainages, and outwash channels; volcanic mudflow deposits and landslide deposits. The project is located upon a relatively flat floodplain containing primarily fine-grained alluvium overlying coarser grained alluvium.

3.2 Soil Conditions

The detailed subsurface conditions encountered in the borehole advanced during this investigation, together with the results of laboratory tests carried out on selected soil samples are presented on the Record of Borehole and CPT Sheets, see Appendix A and B. It should be noted that the stratigraphic boundaries shown on the borehole record is inferred from non-continuous sampling, observations of drilling progress, SPT results and laboratory test data. These boundaries typically represent transitions from one soil type to another and should not be regarded as exact planes of geological change. Further, subsurface conditions will vary between and beyond the borehole locations.

Based on the results of our recent subsurface explorations, the soils generally consist of very loose to compact sand alluvial deposits and very soft to firm silty clay and clayey silt alluvium/flood deposits overlying dense sand alluvial deposits. Descriptions for these soil units are provided below.

- **Alluvium**: These deposits were encountered near the ground surface to the bottom of each boring. The alluvium deposits consist of very loose to dense, nonstratified to weakly stratified sand with trace to some gravel, trace to little silt and trace organics. These alluvial deposits are, at times, interbedded with finer grained alluvium/flood deposits. The alluvium becomes dense below a depth of about 82 feet below ground surface.

- **Alluvium/Flood Deposits**: These deposits were encountered from the ground surface to a maximum depth of 74.0 feet below the existing ground surface. The alluvium/flood deposits consisted of very soft, nonstratified to weakly stratified, clayey silt and silty clay with trace fine sand, trace organics and trace peat layers. The alluvium/flood deposits were interbedded with the coarser grained alluvium deposits.

The following represents a simplified design site stratigraphy based on the borehole and CPT data.
### Layer Details

<table>
<thead>
<tr>
<th>Layer Number</th>
<th>Soil Designation (i)</th>
<th>Depth (ft)</th>
<th>Average $N_{160}$ (ii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upper Clay</td>
<td>0 to 7</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Upper Sand</td>
<td>7 to 15</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Intermediate Clay (a)</td>
<td>15 to 18</td>
<td>3 to 4</td>
</tr>
<tr>
<td>4</td>
<td>Intermediate Sand (a)</td>
<td>18 to 21</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Intermediate Clay (b)</td>
<td>21 to 34</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Intermediate Sand (b)</td>
<td>34 to 38</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Lower Clay</td>
<td>38 to 70</td>
<td>3 to 4</td>
</tr>
<tr>
<td>8</td>
<td>Interlayered Silts</td>
<td>70 to 82</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Lower Sand</td>
<td>82 to 100</td>
<td>20 to 50 increasing with depth</td>
</tr>
</tbody>
</table>

**Notes:**

(i) A simplified soil designation has been utilized for soil types. Clay represents a clayey silt to silty clay (MH) and sand represents a range of sand trace silt to silty sand (SP-SM).

(ii) $N_{160}$ value represents SPT blow counts corrected for depth and hammer energy.

### 3.3 Groundwater Conditions

Groundwater was encountered at a depth eight feet below the existing ground surface at the time our field explorations. A 1-inch piezometer was installed in the borehole to allow further groundwater monitoring. It is reasonable to assume that the groundwater surface fluctuates seasonally and that groundwater levels may be higher during wetter portions of the year. The measured groundwater level is shown on the borehole record in Appendix A. The groundwater level was measured at a depth of 8.4 feet below ground surface on January 21, 2004.
4.0 ENGINEERING RECOMMENDATIONS

This section of the report provides our interpretation of the factual geotechnical data obtained during the current investigation. The recommendations provided are intended for the guidance of the design engineers and are intended for this project only. The data may not be sufficient for construction and where comments are made on construction, they are provided only to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking the works must make their own interpretation of the subsurface information provided as it affects their proposed construction methods, costs, equipment selection, scheduling, safety and the like.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous site activities or uses of the site and/or resulting from the introduction onto the site of materials from off site sources are outside the terms of reference for this report and have not been investigated or addressed.

This report addresses aspects of the foundation design for the proposed structures. We understand that the configuration of buildings proposed for the site has not been finalized. The project information utilized for the preparation of this report was provided by ARC Architects and KPFF.

For design purposes a groundwater level at Elevation 8.5 feet was utilized.

4.1 Seismic Criteria

We understand that the project will be designed using the 1997 UBC seismic design criteria. The project is located in seismic zone 3 and the seismic zone factor (z) is therefore 0.3. Based on our boring and CPT data, a site coefficient for soil characteristics designation of $S_E$ can be assumed for the calculation of shear and lateral load on the building. However, the upper 100 feet of soil contains soil zones that are susceptible to liquefaction which would imply that a site specific dynamic soil response is required and a soil characteristics designation of $S_p$ would be appropriate. We have carried out a liquefaction assessment which is discussed below and we consider that the settlements calculated from that assessment combined with the $S_E$ site designation for calculation of structure loads will be conservative. A site specific dynamic response where the ground surface response is calculated, when taking into account liquefaction occurring in the soil, is beyond the current scope of our work.

We consider that a Magnitude 7.5 earthquake is appropriate for design and assuming the source zone is over 10 km away.

4.1.1 Liquefaction Assessment

The potential for soil liquefaction at the site was evaluated. Liquefaction refers to the temporary loss of soil shear strength due to increased pore water pressure, and a corresponding decrease in effective stress. This condition can develop in cohesionless soils subjected to cyclic loading. The main consequences of liquefaction are settlement, loss of foundation support and lateral spreading. The settlement which occurs can induce downdrag loads and lateral spreading can impose horizontal loading on a deep foundation system (piles, drilled shafts).

Based on USGS seismic hazard maps and assuming a Magnitude 7.5 earthquake with a 10 % probability of occurring in 50 years the design seismic event would have a peak acceleration of about 0.25 g. Note that the peak acceleration obtained from the USGS is bedrock acceleration and does not
include any amplification or damping effect of the soil column. For assessment purposes and based on experience this value was not amplified through the soil column and a ground surface value of 0.25 g was assumed. As noted above a full site dynamic response assessment would be required if the liquefaction occurring in the soil were to be taken into account.

Several methods exist for the evaluation of liquefaction potential; however the most frequently used involve empirical correlations developed by Seed et al (1971, 1983). This method involves calculation of the earthquake induced cyclic shear stress and comparison with the liquefaction or cyclic resistance derived from in-situ testing. If the induced cyclic shear stress is greater than the cyclic resistance then the analysis indicates that liquefaction is likely to occur.

The induced cyclic shear stress was calculated using the simplified procedure of Seed and Idriss (1971) using the design peak surface acceleration.

The liquefaction or cyclic resistance was calculated using the NCEER procedure described in “Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils” held in Salt Lake City, January 1996. The procedure utilizes several corrections to the recorded CPT tip resistance ($q_t$), including vertical effective stress and fines contents, to develop a corrected tip resistance ($q_{LINC6}$) which is then correlated with liquefaction resistance. The liquefaction resistance or cyclic resistance ratio can then be compared with the induced cyclic stress ratio.

The results of the liquefaction assessment are shown in Figure 3. The figure shows the induced stress ratio from the Magnitude 7.5 event for the peak acceleration of 0.25g and the liquefaction resistance for each CPT value. Clay samples are considered to be non-liquefiable and are assigned a CRR of 0.5. The results indicate that liquefaction of seams/layers within the upper 12 feet to 25 feet, 40 to 55 feet and 65 to 75 feet of saturated granular deposits is likely to occur. The dense sand/gravel deposits and clay deposits are not liquefaction susceptible. The total thickness of liquefiable material was calculated to be about 20 to 25 feet.

An assessment of the post liquefaction settlement was carried out according to the method described by Tokimatsu and Seed (1987). The analysis indicated that between 4 inches to 6 inches of total settlement was likely to occur following the design seismic event. The settlement would probably occur relatively uniformly across the site with differential settlements on the order of 2 inches. In general, reduction of the liquefaction risk would involve some method of improving liquefaction resistance by increasing relative density. However, the site would be difficult to improve given the interlayered nature of the deposits and we consider that the settlement effects could either be avoided by use of a deep foundation system or allowed for in the design of a shallow foundation system. In either case we recommend that flexible utility connections are utilized at the building interface.

4.2 Foundation Recommendations

We consider that the use of lightly loaded shallow spread footings and/or a deep foundation system is feasible at this site. The deep foundation system could consist of driven steel piles or auger-cast piles. The main issue with respect to the site is that thick deposits of soft to firm clay are present and any foundation system has to be designed with respect to likely long term settlement response. The use of a preload to increase the allowable bearing pressure is also feasible and is discussed below.

4.2.1 Geotechnical Model

The following describes the geotechnical model for the site based on the geotechnical data collected, engineering correlations and experience. In particular the CPT data was utilized to produce
The distributions of undrained shear strength and over-consolidation ratio with depth, see Figures 4 and 5. Note these correlations are appropriate only for the cohesive (clay) type deposits.

<table>
<thead>
<tr>
<th>Layer Number</th>
<th>Soil Designation</th>
<th>Unit Weight (psf)</th>
<th>Compressibility Parameters (i)</th>
<th>Strength Parameters (i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upper Clay</td>
<td>110</td>
<td>$c_c = 0.35, c_r = 0.03, e_o = 1.3$ OCR= 10 at GS to 3 at 7 feet</td>
<td>$S_u = 450$ psf</td>
</tr>
<tr>
<td>2</td>
<td>Upper Sand</td>
<td>120</td>
<td>$E= 160$ tsf</td>
<td>$c = 0 \ \Phi=34$ degrees</td>
</tr>
<tr>
<td>3</td>
<td>Intermediate Clay (a)</td>
<td>110</td>
<td>$c_c = 0.35, c_r = 0.03, e_o = 1.3$ OCR= 2</td>
<td>$S_u = 400$ psf</td>
</tr>
<tr>
<td>4</td>
<td>Intermediate Sand (a)</td>
<td>120</td>
<td>$E = 110$ tsf</td>
<td>$c = 0 \ \Phi=32$ degrees</td>
</tr>
<tr>
<td>5</td>
<td>Intermediate Clay (b)</td>
<td>105</td>
<td>$c_c = 0.6, c_r = 0.04, e_o = 1.5$ OCR= 2 at 21 feet to 1 at 34 feet</td>
<td>$S_u = 400$ psf</td>
</tr>
<tr>
<td>6</td>
<td>Intermediate Sand (b)</td>
<td>120</td>
<td>$E = 160$ tsf</td>
<td>$c = 0 \ \Phi=34$ degrees</td>
</tr>
<tr>
<td>7</td>
<td>Lower Clay</td>
<td>110</td>
<td>$c_c = 0.6, c_r = 0.04, e_o = 1.5$ OCR= 1</td>
<td>$S_u = 400$ psf at 38 to 55 feet increasing to 1000psf at 70 feet</td>
</tr>
<tr>
<td>8</td>
<td>Interlayered Silts</td>
<td>110</td>
<td>$E = 40$ tsf</td>
<td>$S_u = 1000psf at 70 feet to 1400 psf at 82 feet</td>
</tr>
<tr>
<td>9</td>
<td>Lower Sand</td>
<td>125</td>
<td>$E = 50$ tsf at 82 feet to 320 tsf at 100 feet</td>
<td>$c = 0 \ \Phi=36$ degrees</td>
</tr>
</tbody>
</table>

**Notes:**
(i) $c_c = \text{compression index, } c_r = \text{recompression index, } e_o = \text{initial void ratio, } E = \text{Young’s Modulus, } OCR = \text{overconsolidation ratio}$
(ii) $c = \text{effective cohesion } \Phi= \text{effective stress friction angle, } S_u = \text{undrained shear strength}$

### 4.2.2 Spread Footings

Conventional, shallow isolated or continuous spread footings may be used, provided they are founded on a subgrade of undisturbed native. Footings should not be placed on loose uncompacted fills or on topsoil/organic soils. Conventional shallow isolated or continuous spread footing foundations should be designed based on the following parameters:

The following are preliminary recommendations for spread footings.

- Maximum Settlement = 1 inch total, 0.5 inches differential
- Minimum Embedment Depth = 24 inches
- Maximum Footing Size = 24 Inches
- Factor of safety on bearing capacity = 3.0
- Strip footings - width up to 4 feet - Allowable Bearing = 900 psf
- Isolated Footings - up to 6 feet x 6 feet Allowable Bearing = 1,000 psf
  - These values may be increased by 1/3 for short-term wind and seismic loading.
Assumptions – vertical loading with minimum footing sizes.

- Allowable Base Friction factor (FS = 1.5) = 0.35

The response of a mat foundation to uniform loading was also considered using a configuration based on the conceptual design of the proposed structure. A slab loaded to 500 psf would experience long term settlements of up to 4 inches and differential settlements of about 1.5 inches over a length of 50 feet. The major effect of having a widely loaded area is to transmit the load to deeper depths and in this case the lower clay layer begins to have a major influence on settlement as the loaded area increases. This analysis does not include the stiffness of the slab and therefore the actual differential is likely to be less than 1 inch. Additional combinations of slab configuration and subexcavation can be assessed if required.

For preliminary assessment purposes a modulus of subgrade reaction modulus ($k_s$) of 40 kcf may be utilized, for deformations under about 0.25 inches. Note the $k_s$ is referenced to a 1 foot square plate or a beam 1 foot wide. Design using subgrade modulus is an iterative procedure between the structural and geotechnical engineers, as the modulus will change with deformation levels.

4.2.3 Deep Foundations – Auger Cast Piles

The following table summarizes our calculation of auger-cast pile capacity. We have determined that the piles would have to be extended to a depth of about 90 feet (or at least 8 feet into the lower sand deposit) in order to transfer the loads to an acceptable bearing layer and avoid pile settlement problems. A factor of safety of 3.0 has been assumed although this factor can be reduced to 2.0 if a full scale load test is carried out on a test pile to confirm the capacity. For short term transient loading the allowable capacities may be increased by 30 percent.

- Pile Diameter 16 inches – Allowable Capacity = 180 kips
- Pile Diameter 18 inches – Allowable Capacity = 230 kips
- Pile Diameter 24 inches – Allowable Capacity = 350 kips.

The above allowable capacities represent pile deformations of about 0.5 inches to 1 inch. The above capacities only consider geotechnical criteria and structural criteria may limit the allowable loads.

When a preliminary pile design layout has been completed the design should be reviewed to assess settlement of the pile group.

The base of the pile caps should be founded a minimum of 18 inches below ground surface for frost protection purposes.

If required we can provide pile capacities for driven pipe or H-piles.

4.2.3.1 Downdrag Loads

The design seismic event would produce ground settlements of up to 6 inches. This level of settlement would produce downdrag loads on the piles. For design purposes the following downdrag loads may be utilized for design;

- Pile Diameter 16 inches – Downdrag load = 140 kips
- Pile Diameter 18 inches – Downdrag load = 190 kips
• Pile Diameter 24 inches – Downdrag load = 200 kips.

The downdrag loads should be used to check the structural capacity of a pile during seismic loading. The downdrag load will produce additional movement of the pile to mobilize the additional resistance required. An estimate of this movement was made using conventional load transfer relationships for drilled shafts and a movement of about 0.5 inches was estimated. This implies that under the design seismic event a pile would settle 0.5 inches.

4.2.3.2 Horizontal Pile Response

The design of a pile subjected to lateral loads should take into account such factors as relative rigidity of the pile to the surrounding soil, the fixity condition at the head of the pile (pile cap level), the structural capacity of the pile to withstand bending moments, the soil resistance that can be mobilized, the maximum tolerable deflection at the head of the pile and pile group effects. For design purposes, both the structural and geotechnical capacities should be determined to establish the governing case.

The analysis of a pile under lateral loading is a problem in soil-structure interaction. The deflection of the pile is dependent on the soil response and the soil response is a function of the pile deflection. An iterative solution should be employed because the soil response is a non-linear function of pile deflection. A non-linear analysis typically utilizes curves relating the soil response and the pile deflection (p-y curves).

For the seismic design case the subgrade reaction values should be reduced significantly for the cohesionless deposit which liquefies.

This analysis can be carried out once more details, such as type of pile, pile group arrangement, loadings, pile cap fixity and the like have been determined. This process is typically carried out iteratively between the structural and geotechnical engineers.

4.3 Slab Subgrade

Conventional slab-on-grade floors can be supported on a subgrade of the native bearing soils. Slab-on-grade floors should not be founded on organic soils, very soft soils or uncompacted fills. The slabs should be underlain by a capillary break material, consisting of at least four inches of clean, free draining sand and gravel or crushed rock containing less than 3 percent fines passing the #200 sieve (based on the minus No. 4 sieve fraction) meeting the following specification:

**TABLE 4-1**

<table>
<thead>
<tr>
<th>Sieve Size or diameter (in)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>100% Passing</td>
</tr>
<tr>
<td>No. 4</td>
<td>0% - 20%</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 – 3%</td>
</tr>
</tbody>
</table>

A vapor barrier consisting of reinforced heavy plastic sheeting (6 mil or thicker) can be included between the slab and the capillary break. If desired, an additional a two-inch thick layer of sand may be placed on the vapor barrier to aid in concrete curing. The vapor barrier is recommended for all
occupied space, storage area, and any areas to receive floor covering, carpeting, or finishes on the slab.

As an alternative to slab on grade, framed floors can also be used provided adequate subgrade drainage, footing drains, and venting of the crawl space is provided.

4.4 Foundation Drainage

We recommend that all crawl space areas be sloped for drainage and served with a minimum of an interior crawl drain that is connected to an approved storm drainage/outfall system. Additional foundation and slab-on-grade drainage systems may be necessary depending on groundwater presence or foundation design elements. This may include perimeter footing drains or foundation wall treatments for below grade living spaces. A perimeter footing drain is recommended for all external walls. The drainage should consist of a perforated drainpipe placed at the bottom of the footing, enveloped in drain rock and covered with filter fabric. Footing drains should consist of a 4-inch-diameter rigid-walled perforated PVC pipe or equivalent. The pipe should be surrounded by at least 6 inches of clean free-draining sand and gravel, having the gradation specified in Table 4-2. The drain should be tightlined to the storm system or other suitable discharge point.

<table>
<thead>
<tr>
<th>Sieve Size or Diameter (in)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2&quot;</td>
<td>100% Passing</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>10% - 40%</td>
</tr>
<tr>
<td>No. 4</td>
<td>0% - 5%</td>
</tr>
<tr>
<td>No. 200</td>
<td>0% - 2%</td>
</tr>
</tbody>
</table>

Table 4-2

Drain Rock Gradation

Roof drains should be collected and conveyed in a tightlined system separate from the footing drain system. The ground surface adjacent to the buildings should be graded to drain away from the building. Cleanouts should be provided on all drain systems.

4.5 Backfilled Walls

Adequate drainage should be provided for basement walls to minimize lateral earth pressures and to prevent buildup of hydrostatic pressures. The wall backfill should be used in conjunction with footing drains and/or other drainage provisions discussed above to provide full wall drainage. The backfill should be compacted firmly in maximum one-foot thick lifts near the optimum moisture content. The optimum moisture content is the water content at which the soil can achieve the highest density, as determined by ASTM D-1557, Proctor maximum dry density laboratory test. The contractor should avoid over-compaction adjacent to the wall in order to prevent an increase in the earth pressure.

Alternatives to the use of free draining fill behind walls would include continuous geocomposite drain strips placed continuously behind the wall or washed drain rock within 2 feet of the wall for the full height of the wall. Both these alternatives would be used in conjunction with wall footing drainage discussed above.
Backfilled basement walls can be designed for an at-rest earth pressure equivalent to a fluid density of 50 pcf; assuming there is no build up of hydrostatic pressure. The criteria presented section 4.2.2 can be used for preliminary foundation design. Note that the parameters in 4.2.2 are based on a 2 feet embedment below grade and if a basement is required Golder should be given the opportunity to reassess these values.

4.6 Retaining Walls

Retaining walls may be used to accommodate grade changes, and general site grading around buildings. A variety of wall types are feasible, including conventional cast concrete walls, mechanically stabilized earth (MSE) walls, and rockeries. Once the grades are known, and a specific wall type has been decided, detailed design recommendations can be developed. Cast-in-place or gravity walls can be designed with an active earth pressure or equivalent fluid weight equal to 35 pcf assuming a level backslope. In regards to foundations, the recommendations in section 4.2.2 apply to retaining walls as well as building foundations.

Earth Pressures for Retaining Structures:

- Restrainted Walls: 50 pcf
- Cantilevered Walls: 30 pcf

These values assume a fully drained wall condition and flat backslope.

All retaining walls should be constructed with a permanent, full-face drain system. The wall footing drain should consist of a 4-inch diameter, perforated drainpipe bedded in a clean gravel backfill. The footing drain should convey the water under gravity flow, to the storm water collection system.

4.7 Ground Improvement

The potential use of ground improvement was assessed for the site. The use of shallow stone columns (say about 10 to 15 feet in length) bearing on the upper sand layer were considered. However, long term settlement of the improved ground would still be a problem. The stone columns would have to be extended to a depth of 80 to 90 feet to avoid the settlement problems. The use of deep stone columns would help to mitigate the liquefaction risk, improve the allowable bearing pressure and settlement response of the ground. Based on experience and for preliminary assessment purposes a column spacing of about 7 feet would be required and enable the bearing pressure of a mat foundation to be increased to about 2,000 psf.

As an alternative to in-situ ground improvement a preload could be utilized to induce ground settlement and enable a higher allowable bearing pressure to be used. For example a 10 feet preload placed within the building envelope would enable a mat foundation to be designed for a bearing pressure of at least 1,500 psf. A maximum settlement of about 17 inches would be induced by the preload and any surrounding existing structures and/or utility lines could be affected by the settlement zone that would be created. The estimated time that the preload would have to be applied would be on the order of years, given the thickness of the lower clay deposit. The use of wick drains would increase the settlement rate so that an acceptable level of settlement would be reached in few months.

In summary practical options for ground improvement include the use of deep stone columns or preloading with wick drains.
Any design involving ground improvement would benefit from additional laboratory soil testing. In particular consolidation testing of the lower clay testing would enable improved settlement and time rate of consolidation estimates to be made.

4.8 Pavement Design Criteria

It must be recognized that pavement design is a compromise between high initial cost coupled with low maintenance and low initial cost coupled with the need for periodic repairs. As a result, the owner should take part in the development of an appropriate pavement section. Critical features which determine the durability of the pavement surface include: the stability of the subgrade, presence or absence of moisture, free water, traffic volumes, and the frequency of use by heavy trucks.

The paving requirements will be for an interior access roadway in which the frequency of heavy truck use will be very small over the design life of the pavement. Provided that the pavement subgrade is prepared in accordance with the construction recommendations section of this report and the traffic loading is anticipated to be light, the following pavement sections are recommended for interior access roadways.

Recommended Minimum Pavement Section*:

3-inches AC – Class B
6-inches crushed base

A woven separation geotextile conforming to WSDOT Standard Specification Section 9-33, Table 3 shall be installed over approved, prepared subgrade to ensure proper performance of compacted crushed base.

Over firm and unyielding subgrade compacted to at least 95% of modified Proctor (ASTM D1557).

Alternative Pavement Section*:

2-inches AC – Class B
4-inches ATB
Over firm and unyielding subgrade compacted to at least 95% of modified Proctor (ASTM D1557)

*Paving materials and minimum sections should conform to the local municipal criteria.

If paving is required along the frontage of a city or county street, or a roadway within the development is to be a through roadway, the pavement section should be designed for the anticipated traffic loading.

If the moisture content of the native soils do not allow for compaction of the subgrade to be firm and unyielding, the use of admixes, such as cement and flyash, could be considered to improve the subgrade.
5.0 GEOTECHNICAL CONSTRUCTION RECOMMENDATIONS

5.1 General

The on-site soils are moisture sensitive and can become soft and unworkable when wet. It is strongly recommended that the major grading and foundation work be performed in the driest summer months to minimize drainage and subgrade degradation problems and to optimize the use of on-site soil for fill.

Wet weather construction will add considerable cost and extend the construction schedule. It will require considerable off-site granular borrow for fills and/or admixtures to aid in the use of wet soils for structural fill, off-site disposal of wet excavated soils, and extensive use of off-site quarry spalls to maintain access roads.

5.2 Site Preparation/Grading

Site preparation should include removal of all existing structures, utilities, vegetation, root mass, organic soils and any other deleterious materials from building and paving areas or those locations where structural fill is to be placed. Such materials should be wasted from the site or utilized as landscaping fill. If clearing and stripping efforts are not accomplished during or after periods of dry weather during the summer months, much greater depths of soil removal can be expected in any wet or saturated areas present across the site. Stripping should also include removal of any uncontrolled fill and underlying organics and topsoil.

Subgrades to receive structural fill, building foundations, or pavement, should be cleared to expose undisturbed native bearing soils. Prior to placing fill and preparing building and pavement subgrades, we recommend proof rolling all exposed areas to determine if any soft areas are present. If any soft areas are observed, these areas should be either removed and replaced with structural fill or dried back and recompacted. However, the native subgrade will generally be soft to firm and therefore we do not recommend over excavating more than about 2 feet unless organic deposits are encountered. If organic deposits are encountered they should be completely removed. All pavement subgrades should be compacted to at least 95% of modified Proctor maximum dry density (ASTM D1557).

5.3 Temporary Excavation Slopes

Safe temporary excavations are the responsibility of the contractor and depend on the actual site conditions at the time of construction. Temporary cuts are the responsibility of the contractor and should comply with applicable OSHA and WISHA standards. We recommend that temporary cut slopes be excavated no steeper than 1H:1V (45 degrees). Cut slopes exposed for any length of time, particularly during wet weather, should be covered with visqueen to maintain stability and minimize erosion.

5.4 Erosion Control

Erosion control for the site will include the Best Management Practices (BMP's) incorporated in the civil design drawings and may incorporate the following recommendations:

- Limit exposed cut slopes;
- Use silt fences, straw, and temporary sedimentation ponds to collect and hold eroded material on the site;
• Seeding or planting vegetation on exposed areas where work is completed and no buildings are proposed; and
• Retaining existing vegetation to the greatest possible extent.

5.5 Construction Drainage

Even during dry weather, we recommend that site drainage measures be incorporated into the project construction. Construction of a detention pond first, either temporary or permanent, is recommended as these can be used for stormwater and silt traps during construction of the up-slope portions of the site.

Surface runoff can be controlled during construction by careful grading practices. Typically, these include the construction of shallow upgrade perimeter ditches or low earthen berms and the use of temporary sumps to collect runoff and prevent water from damaging slopes and exposed subgrades. All collected water should be directed, under control, to a positive and permanent discharge system such as the storm detention pond or vault. The site will need to be graded at all times to facilitate drainage and minimize the ponding of water.

5.6 Use of On-site Soils

The native surface soils encountered in our investigation will not be suitable for structural fill. Imported granular fill materials will be required for utility trench backfill, road subgrade, and any other structural fill.

On site soils are also not suitable for structural fill behind retaining walls. Structural fill behind retaining wall should be well-graded sand and gravel with less than 10 percent fines (% by weight passing the No. 200 sieve).

5.7 Fill Materials and Placement

We recommend using imported granular fill consisting of well graded material free of organic material, with less than 5 percent fines (that portion of the soil that passes the # 200 sieve). Other fill materials may be used with approval of the engineer.

Maximum Lift Thickness:
• Imported Granular fill 12 inches loose

Minimum Compaction Requirements:
• Beneath Building Foundations and Floors - The fill should be compacted to at least 95% of the ASTM D1557 maximum dry density value for the material. The structural fill beneath footings should at a minimum extend laterally at a 1H:1V slope projected down and away from the bottom footing edge.
• Beneath Roadways and Pavements - The fill should generally be compacted to at least 90% of the ASTM D 1557 maximum dry density value for the material, except within three feet of subgrade elevation, where the fill should be compacted to at least 95% of the ASTM D 1557 maximum dry density value for the material.
• Utility Trench Backfill - The fill should generally be compacted to at least 90% of the ASTM D 1557 maximum dry density value for the material, except in paved and
structural areas where the material should be compacted to at least 95% of the ASTM D 1557 maximum dry density value for the material.

- Non-structural/Landscaped Areas - Firmly compacted.

The structural fill should be compacted with equipment suitable to achieve proper compaction. Effective compaction of the granular glacial soils may be achieved with a large steel drum vibrator roller or hoe-pac compactor. A large steel drum, vibratory roller or hoe-pac compactor will be more suitable to compact granular fills. Thin lifts or work in confined areas can also be compacted with a jumping jack compactor. If density tests taken in the fill indicate that compaction is not being achieved, the fill should be scarified, moisture-conditioned, and recompacted. If the required densities cannot be met then the material can be excavated and replaced or a soil admixture used to dry the soil.

5.8 Auger Cast Piles

Auger cast piles are sensitive to the installation methods and contractor experience. Poor equipment and/or an inexperienced contractor can result in piles that are improperly installed and, in the worst case, piles that are completely “necked” providing essentially no significant resistance. Thus it is essential that auger cast piles are installed by experienced contractors with the full time monitoring of experienced geotechnical field engineers.

General monitoring requirements include the auger down pressure, identification of cuttings, grout pressure, the rate of auger withdrawal, and grout take. It is also recommended that as a minimum one small rebar is placed full depth into the grout after auger removal as a check on hole “necking”. If the rebar cannot be installed to full depth then the pile should be rejected. Typical practical limits on auger cast pile depths would be 18 inch diameter to about 110 feet. The 90 feet pile length is achievable but the contractor should have demonstrated experience with such deep installations. Another potential limitation is the installation depth for reinforcing cages which are typically limited to a depth of about 30 feet.

5.9 Utilities

Maintaining safe utility excavations is the responsibility of the utility contractor. The utility trenches should be backfilled as noted in Fill Placement section (Section 5.7) of this report.

5.10 Construction Monitoring

We recommend that critical site construction elements be observed and documented by a qualified geotechnical consultant. These include: confirming suitable subgrade soils for building foundations and slabs, auger cast pile installation, compaction of structural fills, and utility trench backfill compaction under pavements.
6.0 USE OF THIS REPORT

This report has been prepared for the exclusive use of ARC Architects and their consultants for specific application to this project. Once the proposed project plans have been prepared, we recommend that we be given the opportunity to review the plans and specifications to verify that they are in accordance with our recommendations.

This study has been performed in general accordance with locally accepted geotechnical engineering practice to provide information on the site area. There are possible variations in the subsurface conditions between and adjacent to our exploration area, and in the groundwater conditions with time. We recommend that a contingency for unanticipated conditions be included in the construction contract to either confirm the anticipated conditions and/or provide for remedial action.
7.0 REFERENCES


LEGEND

GB-1  Borehole with Monitoring Well
CPT-1  Core Penetration Test Location

Source: Drawing provided by ARC Architects

FIGURE 2
SITE EXPLORATION PROGRAM
ARCWSU GEOTECH INVESTIGATION/WA
Golder Associates
Results of Liquefaction Assessment

ARC/Mount Vernon/WA 033-1040

Golder Associates
FIGURE 4

Undrained Shear Strength Summary
ARC/Mount Vernon/WA 033-1040

Golder Associates
FIGURE 5
Over Consolidation Ratio Summary
ARC/Mount Vernon/WA 033-1040
Golder Associates
APPENDIX A

RECORD OF BOREHOLES
### Unified Soil Classification System

<table>
<thead>
<tr>
<th>Criteria for Assigning Group Symbols and Names</th>
<th>Soil Classification</th>
<th>Component Definitions by Gradation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COARSE-GRAINED SOILS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 50% of coarse fraction retained on</td>
<td></td>
<td>Boulders Above 12 in.</td>
</tr>
<tr>
<td>No. 200 sieve</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GRAVELS</strong></td>
<td></td>
<td>Cobble 3 in. to 12 in.</td>
</tr>
<tr>
<td>More than 50% of coarse fraction retained on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 4 sieve</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CLEAN GRAVELS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5% fines</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GRAVELS WITH FINES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 12% fines</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SANDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50% or more of coarse fraction passes No. 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sieve</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CLEAN SANDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5% fines</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SANDS WITH FINES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 12% fines</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **FINE- GRAINED SOILS**                       |                     |                                     |
| More than 50% of coarse fraction              |                     |                                     |
| passed the No. 100 sieve                      |                     |                                     |
| **SILTS AND CLAYS**                           |                     |                                     |
| Liquid limit less than 50                     |                     |                                     |
| **INORGANIC**                                 |                     |                                     |
| **ORGANIC**                                   |                     |                                     |
| **SILTS AND CLAYS**                           |                     |                                     |
| Liquid limit greater than 50                  |                     |                                     |
| **INORGANIC**                                 |                     |                                     |
| **ORGANIC**                                   |                     |                                     |

| **HIGHLY ORGANIC SOILS**                      |                     |                                     |
| Primarily organic matter, dark in color, and  |                     |                                     |
| organic odor                                  |                     |                                     |
| **PT**                                        |                     |                                     |

### Relative Density or Consistency Utilizing Standard Penetration Test Values

<table>
<thead>
<tr>
<th>Cohesionless Soils (a)</th>
<th>Cohesive Soils (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density (c)</td>
<td>N, blows/ft. (c)</td>
</tr>
<tr>
<td>Relative Density (%)</td>
<td>Consistency</td>
</tr>
<tr>
<td>Very Loose</td>
<td>0 to 4</td>
</tr>
<tr>
<td>Loose</td>
<td>4 to 10</td>
</tr>
<tr>
<td>Compact</td>
<td>10 to 30</td>
</tr>
<tr>
<td>Dense</td>
<td>30 to 50</td>
</tr>
<tr>
<td>Very Dense</td>
<td>over 50</td>
</tr>
</tbody>
</table>

(a) Soils consisting of gravel, sand, and silt, either separately or in combination, possessing no characteristics of plasticity, and exhibiting drained behavior.

(b) Soils possessing the characteristics of plasticity, and exhibiting undrained behavior.

(c) Refer to text of ASTM D 1586-84 for a definition of N; in normally consolidated cohesionless soils, Relative Density terms are based on N values corrected for overburden pressures.

(d) Undrained shear strength = 1/2 unconfined compression strength.

### Descriptive Terminology Denoting Component Proportions

<table>
<thead>
<tr>
<th>Trace</th>
<th>0-5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTH</td>
<td>5-12%</td>
</tr>
<tr>
<td>Some or Adjective (a)</td>
<td>12-30%</td>
</tr>
<tr>
<td>AND</td>
<td>30-50%</td>
</tr>
</tbody>
</table>

(a) Use Gravelly, Sandy or Silty as appropriate.

### Laboratory Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>(1)</td>
</tr>
<tr>
<td>Density</td>
<td>D</td>
</tr>
<tr>
<td>Grain Size</td>
<td>G</td>
</tr>
<tr>
<td>Hydrometer</td>
<td>H</td>
</tr>
<tr>
<td>Atterberg Limits</td>
<td>(1)</td>
</tr>
<tr>
<td>Consolidation</td>
<td>C</td>
</tr>
<tr>
<td>Unconfined</td>
<td>U</td>
</tr>
<tr>
<td>UC Triax</td>
<td>UU</td>
</tr>
<tr>
<td>CD Triax</td>
<td>CD</td>
</tr>
<tr>
<td>Permeability</td>
<td>P</td>
</tr>
</tbody>
</table>

(1) Moisture and Atterberg Limits plotted on log.

### Silt and Clay Descriptions

<table>
<thead>
<tr>
<th>Description</th>
<th>Typical Unified Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silt</td>
<td>ML (non-plastic)</td>
</tr>
<tr>
<td>Clayey Silt</td>
<td>CL—ML (low plasticity)</td>
</tr>
<tr>
<td>Silty Clay</td>
<td>CL</td>
</tr>
<tr>
<td>Clay</td>
<td>CH</td>
</tr>
<tr>
<td>Plastic Silt</td>
<td>MH</td>
</tr>
<tr>
<td>Organic Soils</td>
<td>OL, OH, PI</td>
</tr>
</tbody>
</table>

### Figure

SOIL CLASSIFICATION/LEGEND
### Soil Profile

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Boring Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 4.0</td>
<td>Hollow Stem Auger</td>
<td>Very soft, olive gray to reddish brown, mottled, nonstratified, CLAYEY SILT, trace organics, moist to wet. (ALLUVIUM/FLOOD DEPOSITS)</td>
</tr>
<tr>
<td>5.0 - 24.0</td>
<td>Hollow Stem Auger</td>
<td>Very loose to compact, medium gray, nonstratified to weakly stratified, fine SAND, trace to little silt, trace organics, trace 1-h. silt interbeds @ 22 ft, depth, trace organics, wet. (ALLUVIUM)</td>
</tr>
</tbody>
</table>

#### Sample Information

<table>
<thead>
<tr>
<th>Sample</th>
<th>Material Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1: LL - 52; PL - 37; PI - 15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Penetration Resistance

<table>
<thead>
<tr>
<th>Layer</th>
<th>BLOWS per 6 in</th>
<th>REC/ATT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0</td>
<td>1.5</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>4</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>5</td>
<td>1.6</td>
<td>1.5</td>
</tr>
</tbody>
</table>

#### Water Levels

- Concrete and flush mount monument
- Bentonite Gel
- 1-in. PVC riser

---

**Logged by:** T. Sager  
**Checked by:** AJW  
**Date:** 2/26/2004
### BOREHOLE RECORD

**DRILLING CONTRACTOR:** Hall Drilling

**DRILLER:** Mike Reynolds

**LOGGED:** A. J. Sear

**DATE:** 2/26/04

---

### GRAPHIC LOG

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Blows per 6 in</th>
<th>Blows per 1 ft</th>
<th>Penetration Resistance</th>
<th>Water Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>1.0</td>
<td>0</td>
<td>0</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>1.5</td>
<td>0</td>
<td>0</td>
<td>0.5</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note:** Blows per 1 ft are not reported.

---

### BORING METHOD

**Description:**
- 4.25 in. I.D. HSA w/140 lb. autohammer

**Soil Profile:**
- Sand
- Sandy gravel
- Bedrock

**Elevation:** 180 (Estimated)
<table>
<thead>
<tr>
<th>SOIL PROFILE</th>
<th>BORING METHOD</th>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
<th>USCS GRAPHIC LOG</th>
<th>ELEV. DEPTH (ft)</th>
<th>TYPE</th>
<th>BLOWS per 6 in hammer</th>
<th>N</th>
<th>PENETRATION RESISTANCE (BLOWS/R)</th>
<th>WATER CONTENT (PERCENT)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>74.0 - 82.0</td>
<td>Very loose, medium gray, nonstratified, fine SAND, trace gravel trace silts, wet. (ALLUVIUM) (Continued)</td>
<td>82.0</td>
<td>SP-SW</td>
<td></td>
<td></td>
<td></td>
<td>30 lbf hammer</td>
<td></td>
<td></td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>82.0 - 99.0</td>
<td>Dense to very dense, dark grey, weakly stratified, fine to coarse SAND, little to some gravel, trace silts, wet. (ALLUVIUM)</td>
<td>99.0</td>
<td>SW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>W</td>
<td></td>
</tr>
</tbody>
</table>

14in. #20 slot PVC screen
Silica Sand
Hole slough

Boring completed at 99.0 ft.

1 in to 3 ft

LOGGED: T. Sager
CHECKED: AJW
DATE: 2/26/2004
APPENDIX B

RECORD OF CPT'S
Cone Penetration Test - CPT-01

Test Date: 1/8/2004
Location: Mt. Vernon WSU

Operator: NW Cone

Ground Surf. Elev.: 0.00
Water Table Depth: 14.00

Qt (tsf)
PWP (tsf)
Friction (tsf)
Ic
N1(60) (blows/ft)

Depth in feet bgs

Qt normalized for unequal end area effects

After Robertson and (Fear) Wride (1998)
Ic < 1.31 - Gravelly sands
1.31 < Ic < 2.05 - Clean to silty sand
2.05 < Ic < 2.60 - Silty sand to sandy silt
2.60 < Ic < 2.95 - Clayey silt to silty clay
2.95 < Ic < 3.60 - Clays

After Jefferies and Davies (1993)
Cone Penetration Test - CPT-01

Test Date: 1/8/2004
Location: Mt. Vernon WSU
Operator: NW Cone
Ground Surf. Elev.: 0.00
Water Table Depth: 14.00

Qt (tsf)
PWP (tsf)
Friction (tsf)
Ic
N1(60) (blows/ft)

Depth in feet lbs

Qt normalized for unequal end area effects

After Robertson and (Peow) Wride (1998)
Ic < 1.31 - Gravelly sands
1.31 < Ic < 2.05 - Clean to silty sand
2.05 < Ic < 2.60 - Silty sand to sandy silt
2.60 < Ic < 2.95 - Clayey silt to silty clay
2.95 < Ic < 3.60 - Clays

After Jeffries and Davies (1993)
Cone Penetration Test - CPT-02

Test Date: 1/8/2004
Location: Mt Vernon WSU
Operator: NW Cone
Ground Surf. Elev.: 0.00
Water Table Depth: 8.50

Qt (tsf) | PWP (tsf) | Friction (tsf) | lc | N1(60) (blows/ft)

Depth in feet:
0  5  10  15  20  25  30  35  40  45  50

Qt normalized for unequal end area effects

After Robertson and (Peer) Wride (1998)
1c < 1.31 - Gravely sands
1.31 <lc < 2.05 - Clean to silty sand
2.05 <lc < 2.60 - Silty sand to sandy silt
2.60 <lc < 2.95 - Clayey silt to silty clay
2.95 <lc < 3.60 - Clays

After Jeffery and Davies (1993)

ARC/WSU Geotechnical Investigation

PROJECT NO. 033-1040    DATE: March 5, 2004    DRAWN BY: AJW
PART 1 GENERAL

1.01 SUMMARY

A. Contractor shall perform the entire Work in accordance with the Contract Documents.

B. Without limiting the requirements of the Contract Documents, the Work of the Contract can be summarized as follows:

1. Construct a 1,800 SF wood-framed head-house on the WSU Mt Vernon Research and Education Center to support future greenhouses. Building includes office space with restroom and shelled lab space and potting areas. Underground utilities will be extended to the building.

C. Expected Owner-supplied Contractor-installed Work: NONE.

D. Expected Work by Owner: NONE.

1.02 SCHEDULE OF ALTERNATES – NOT USED

1.03 SCHEDULE OF ALLOWANCES – NOT USED

1.04 SCHEDULE OF UNIT PRICES – NOT USED

1.05 GENERAL INFORMATION

A. Owner and Owner’s Designated Representative:

1. Owner: Board of Regents
   Washington State University
   Pullman, WA 99164-1045

2. Owner’s Designated Representative:
   a. All Owner capital projects are administered by the Department of Facilities Services, Capital. Project specific designated representatives are listed within the Agreement.

3. Consulting Services: Owner has retained an Architect/Engineer to design the entire Project. The Architect/Engineer is identified below, as are others involved as members of the Owner team working on the Project:
   a. Architect/Engineer: Carletti Architects, P.S.
   b. Civil Engineer: Sound Development Group
   c. Structural Engineer: Davido Consulting Group, Inc.
   d. Mechanical Engineer: Harris Group
   e. Electrical Engineer: K Engineers, Inc.
1.06 SPECIAL CONDITIONS

A. Site Access:

1. The east campus entrance accessing the paved parking lot must remain open to use at all times except for infrequent, short-term events that are coordinated with and approved by the University a minimum of 72 hours in advance. In no case shall any temporary closure of this entrance occur during previously-scheduled Center events or activities that the public are invited to attend. Any closure shall also be coordinated with Skagit County Fire District 2 to determine an acceptable alternate fire access. Contractor parking is allowed in the nine (9) paved spaces on the east end of the parking lot, and in the gravel area between the construction site and the Tree House. Laydown area is allowed in the grass area immediately south of the construction site.

B. Schedule and Phasing:

1. Construction activities shall not occur during the WSU Mount Vernon REC Field Day, which begins at 3:00pm on July 9. Contractor will coordinate with the University prior to other public events held on the campus to allow appropriate access to events. Utility shutdowns must be coordinated closely with WSU Mount Vernon REC and may need to be limited in duration due to the critical need for irrigation and greenhouse cooling during the growing season. Noisy work shall not occur prior to 7:00am due to adjacent residential properties.

C. Owner Occupancy:

1. The adjacent buildings are in active research use by the University. The Contractor shall coordinate utility shutdowns, driveway access, and other aspects of the construction with the University.

D. Hazardous Material:

1. No hazardous materials are known to exist on the work site.

END OF SECTION 01 11 00
PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the administrative and procedural requirements for executing changes in the Work. This Section is subject to and governed by the Agreement and General Conditions. In the event of any conflict, the Agreement and General Conditions will have a higher precedence as established in the General Conditions.

1.02 SUBMITTALS

A. Contractor shall submit a breakdown of its actual wage rates prior to commencement of construction activities. The breakdown must show:

1. Basic wage rate (Based on L&I Intent to Pay Prevailing Wages);
2. Fringe Package (Based on L&I Intent to Pay Prevailing Wages);
3. FUI (Federal Unemployment Insurance);
4. FICA (Federal Insurance Compensation Act);
5. SUI (State Unemployment Compensation Act);
6. Medicare; and
7. WC (Workers Compensation).

B. Contractor shall submit detailed supporting documentation to verify the above rates, if requested by Owner. All such rates shall be subject to audit.

C. Contractor shall submit prior to commencement of construction activities a list of all equipment that it anticipates will be used on the Project and the actual operating cost of each piece of equipment. The General Conditions describe allowable equipment charges. All costs shall be subject to audit.

1.03 CONTRACT CHANGE PROPOSAL PROCEDURES

A. Contractor shall maintain an Issues Log/ CCP Log as described in the General Conditions:

1. The action status shall indicate which party is currently responsible and when it is appropriate to submit a CCP to Owner. Contractor shall submit a Contract Change Proposal (CCP) with Substantiating Documentation, as described in subsection C below, to Owner within 7 Days of this action status change.

2. Upon final agreement and authorization by Owner a CCP may be incorporated into the Contract via Change Order and shall be reflected on the Issues Log.
B. Direction to perform Work:

1. Owner may directly order Work by a written Work Directive (WD). WDs may be unilateral or bilateral as described in the General Conditions and may be issued on a fixed price or on a "cost-not-to-exceed" basis. The WD may include the following:
   a. A detailed description of the proposed change, products, and location of modification to the Work;
   b. Supplementary or revised Drawings and/or Specifications; and
   c. Projected time for making the change and a statement as to whether overtime work is, or is not, acceptable.

C. Substantiating Documentation required with all CCPs:

1. Contractor shall provide back-up documentation required to substantiate any proposed change in the following format:
   a. CCP narrative, including:
      1) Description of proposed change. In order to allow for efficient review of a change proposal Contractor shall provide enough narrative to the line item breakdown to allow Owner to properly assess that the change is fair and reasonable;
      2) Cause of or reason for making change with a statement of why proposed change is not covered by Contract Documents
      3) Both credited and additive elements relating to a change in Contract Sum and/or Contract Time;
      4) A specific period of time during which Contractor’s pricing will be considered valid;
      5) Any schedule considerations that may trigger further impact to the Contract Time if acceptance of the proposed change if delayed beyond a specific date; and
      6) Date change Work is to be completed.
   b. Owner supplied Change Proposal Submittal Form.
   c. CCP Cost Estimate Detail Sheet(s), or other form acceptable to Owner, including:
      1) Line-item estimate detailing material, labor, equipment, Subcontractor, and supplier costs and quantities; and
      2) Subcontractor and supplier proposals with supporting line-item estimates.
   d. CCP Progress Schedule with Contemporaneous Period Analysis detailing if any impact to the planned progress of the Work and
critical path.

e. Other supporting documentation, as appropriate.

D. Correlation with Contractor's Submittals:

1. Application for Payment forms shall record each Unilateral and Bilateral Change Order as a separate item of Work.

2. The Progress Schedule shall be revised to reflect changes in the Contract Time.

3. Project Record shall incorporate all changed Work.

END OF SECTION 01 26 00
PART 1   GENERAL

1.01   SUMMARY

A. This Section includes procedures for preparation and submittal of Applications for Payment.

1.02   SUBMITTALS

A. Prior to submitting its first Application for Payment, Contractor shall:

1. Submit a preliminary Progress Schedule per Section 01 32 13 – Progress Schedule.

2. If requested, submit a projected monthly cash-flow analysis for the duration of the Project.

3. Submit an approved Intent to Pay Prevailing Wages form prior to commencing the Work. An approved Intent to Pay Prevailing Wages form must be on file with Owner for each classification of laborers, workers, or mechanics employed by Contractor or Subcontractors whose Work is included in an Application for Payment.

4. “Washington State Prevailing Wage Rates for Public Works Contracts/Skagit County” are made a part of the Contract Documents and are included at the end of this Section. It is Contractor’s responsibility to verify with the Washington State Department of Labor and Industries the most current and applicable prevailing wage rates for this Project.

5. Submit and receive approval of the Schedule of Values per Section 01 29 73 – Schedule of Values, and the General Conditions. All Applications for Payment shall be in the same format.

6. Submit a list of all Subcontractors with points of contact and other contact information, including phone number, email address, and mailing address.

7. Submit a list of all major material suppliers with points of contact and other contact information, including phone number, email address, and mailing address.

8. Submit Retainage Option Form to Owner for the disposition of retainage funds.

a. In accordance with Chapter 60.28 of the Revised Code of Washington (RCW), Owner shall reserve retainage not to exceed 5% of the monies earned by Contractor as a trust fund for the protection and payment of:

1) The claims of any person and/or Owner arising out of or relating to Work performed on the Project; and

2) The State with respect to taxes, fees, or penalties that may be imposed and due from Contractor (see General
Conditions).

b. Retainage will be released per Section 01 70 00 - Project Close-Out.

c. At the option of Contractor, the moneys reserved by Owner shall be:

1) Retained in a fund by Owner;

2) Bonded for all of the retainage using a bond form acceptable to Owner;

3) Placed in escrow with a bank or trust company by Owner.

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

b) Escrow Agent: If Contractor elects the escrow option, an escrow agreement shall be executed by Contractor, Owner, and bank or trust company. Three copies of the agreement should be completed and executed by Contractor and returned to Owner for execution; Owner will forward copies to the bank or trust company for receipt, acceptance, and execution. The bank or trust company will retain one copy and return one copy each to Contractor and Owner. A completed and signed escrow agreement must be on file with Owner before Contractor’s first Application for Payment is processed.

c) Escrow Investments: The bank or trust company may invest the retained funds in bonds and other securities selected by Contractor, except stocks, subject to the written approval of Owner.

d) The investments selected must mature on or prior to the date 45 Days following Final Acceptance of the Work. Interest on such investments may be paid to Contractor as it accrues.

e) Escrow Costs and Fees: All escrow costs and fees shall be paid by Contractor.

f) Release of Escrow Investments to Contractor: Retainage will be released per Section 01 70 00 - Project Close-Out. Once Contractor has fully complied with the Contract Documents and statute, Owner shall issue written instructions to the bank or trust company to release to Contractor the investment held in escrow.
B. Draft Application for Payment:

1. Contractor shall submit a draft, itemized Application for Payment within the last 7 Days of the month.

2. The draft application does not constitute a payment request and shall not be signed.

3. Contractor shall carefully check all extensions, totals, and required information for accuracy before submittal.

4. Contractor and Owner may meet to confer regarding the current progress of the Work and the amount of payment to which Contractor is entitled. Owner may request that Contractor provide supporting documentation substantiating its right to payment. Contractor is not entitled to make a final payment request, nor is any payment due Contractor, until such data is furnished. Contractor may include in its Application for Payment projected costs to the end of the month.
   a. Fill in the following information within Owner's Application for Payment form:
      1) Percentage of Work completed based upon the approved schedule of values.
      2) List Change Orders approved by Owner prior to submission date. Use Owner’s designations. Do not bill for changed Work until a fully executed Change Order has been received.
      3) Certification of Participation WBE and MBEs, all certification types acceptable, supply this regardless of having firms to report upon.
      4) List all Subcontractors that have performed Work at the site during the pay period.
      5) If applicable, Apprentice/Journeyman Participation.

5. Contractor shall submit or make available for review the following prior to the draft Application for Payment:
   a. Project Record; (see Section 01 78 39 – Project Record)
   b. Updated Progress Schedule in native format (see section 01 32 13 – Progress Schedule);
   c. Contractor Quality Control Reports (see Section 01 45 00 - Quality Control); and
   d. Stored Materials: Requests for payment of stored materials may only be made for materials properly stored on or off-site and in full compliance with the General Conditions.

C. Application for Payment:
1. Contractor may not submit the approved Application for Payment (or payment will be withheld) until all requirements of the draft application for payment are met.

2. Upon approval of the Draft Application for Payment, contractor will be authorized to submit the agreed upon Application for Payment for processing and payment. This application for payment shall be signed by hand by a responsible officer of the Contractor and may be submitted in scanned format electronically.

3. Formal submittal must include all parts of the Application for Payment form.

4. Owner shall make progress payments in such amounts as it determines are properly due within 30 Days of receipt of a properly executed Application for Payment.

5. 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.

D. Disputed Amounts: If Contractor believes it is entitled to payment for Work performed during the prior calendar month in addition to the agreed-upon amount, Contractor may, also within the same period, submit to Owner along with the approved Application for Payment a separate, written payment request specifying the exact additional amount claimed due, the category in the Schedule of Values in which the payment is claimed due, the specific Work for which the additional amount is due, and why the additional payment is due. Furthermore, for the submittal to be considered, Contractor and all Subcontractors shall file with Owner by the same date certified copies of all payroll records relating to the additional amount due, pursuant to WAC 296-127-320.

E. Payments to Subcontractors: Contractor shall pay each Subcontractor no later than 10 Days after receipt of payment from Owner the amount to which the Subcontractor is entitled. Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to lower-tier Subcontractors in a similar manner.

1. Applications for Payment shall not request payment for portions of the Work that Contractor does not intend to pay a Subcontractor, unless such Work has been performed by others whom Contractor intends to pay.

2. If, after making an Application for Payment but before paying a Subcontractor for its performance covered by the Application, Contractor discovers that part or all of the payment otherwise due to the Subcontractor is subject to withholding from the Subcontractor under the Subcontract (such as for unsatisfactory performance or non-payment of lower-tier Subcontractors), Contractor may withhold the amount as allowed under the Subcontract, but it shall:
   a. Give the Subcontractor and Owner written notice of the withholding as soon as practicable once Contractor determines the cause for the withholding but before the due date of the
Subcontractor payment;

b. Include the reasons for the withholding and the actions the Subcontractor must take to release the payment; and

c. Once Subcontractor has taken the required remedial actions, pay Subcontractor within 8 Days.

3. Owner may, at its sole option, issue joint checks to Contractor and to any Subcontractor. If Owner makes payments by joint check, such value shall be reflected on the next Application for Payment.

F. Application for Final Payment:

1. Application for Final Payment will be accepted for processing only after Contractor has completed the requirements of Final Completion as described in Section 01 70 00 – Project Close-Out.

G. Release of Retainage:

1. Retainage will be released per Section 01 70 00 - Project Close-Out.

END OF SECTION 01 29 00
### Washington State Prevailing Wage

The PREVAILING WAGES listed here include both the hourly wage rate and the hourly rate of fringe benefits. On public works projects, worker’s wage and benefit rates must add to not less than this total. A brief description of overtime calculation requirements are provided on the Benefit Code Key.

#### Journey Level Prevailing Wage Rates for the Effective Date: 2/29/2020

<table>
<thead>
<tr>
<th>County</th>
<th>Trade</th>
<th>Job Classification</th>
<th>Wage</th>
<th>Holiday</th>
<th>Overtime</th>
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<tr>
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<td>Asbestos Abatement Workers</td>
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https://secure.lni.wa.gov/wagelookup/
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</tr>
<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Caisson Worker</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
</tr>
<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Carpenter Tender</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
</tr>
<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Cement Dumper-paving</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
</tr>
<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Cement Finisher Tender</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
</tr>
<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Change House Or Dry Shack</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
</tr>
<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Chipping Gun (30 Lbs. And Over)</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
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<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Chipping Gun (Under 30 Lbs.)</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
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<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Choker Setter</td>
<td>$50.86</td>
<td>7A</td>
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<td>Skagit</td>
<td>Laborers</td>
<td>Chuck Tender</td>
<td>$50.86</td>
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<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Clary Power Spreader</td>
<td>$51.80</td>
<td>7A</td>
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<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Clean-up Laborer</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
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<tr>
<td>Skagit</td>
<td>Laborers</td>
<td>Concrete Dumper/Chute Operator</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
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<td>Skagit</td>
<td>Laborers</td>
<td>Concrete Form Stripper</td>
<td>$50.86</td>
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<td>Concrete Placement Crew</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<td>Skagit Laborers</td>
<td>Concrete Saw Operator/Core Driller</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
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<tr>
<td>Skagit Laborers</td>
<td>Crusher Feeder</td>
<td>$43.11</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Curing Laborer</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<td>Skagit Laborers</td>
<td>Demolition: Wrecking &amp; Moving (Incl. Charred Material)</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Ditch Digger</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Diver</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Drill Operator (Hydraulic, Diamond)</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
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<td>Skagit Laborers</td>
<td>Dry Stack Walls</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Dump Person</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Epoxy Technician</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<td>Skagit Laborers</td>
<td>Erosion Control Worker</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Faller &amp; Bucker Chain Saw</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Fine Graders</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
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<tr>
<td>Skagit Laborers</td>
<td>Firewatch</td>
<td>$43.11</td>
<td>7A</td>
<td>4V</td>
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<td>Skagit Laborers</td>
<td>Form Setter</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Gabian Basket Builders</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>General Laborer</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Grade Checker &amp; Transit Person</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Grinders</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
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<td>Skagit Laborers</td>
<td>Grout Machine Tender</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Groutmen (Pressure) Including Post Tension Beams</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Guardrail Erector</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Hazardous Waste Worker (Level A)</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Hazardous Waste Worker (Level B)</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Hazardous Waste Worker (Level C)</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>High Scaler</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Jackhammer</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Laserbeam Operator</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Maintenance Person</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Manhole Builder-Mudman</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Material Yard Person</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Motorman-Dinky Locomotive</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Nozzleman (Concrete Pump, Green Cutter When Using Combination Of High Pressure Air &amp; Water On</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Pavement Breaker</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Pilot Car</td>
<td>$43.11</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Pipe Layer Lead</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Pipe Layer/Tailor</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Pipe Pot Tender</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Pipe Reliner</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Pipe Wrapper</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Pot Tender</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Powderman</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Powderman's Helper</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Power Jacks</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Railroad Spike Puller - Power</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Raker - Asphalt</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Re-timberman</td>
<td>$52.44</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Remote Equipment Operator</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Rigger/Signal Person</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Rip Rap Person</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Rivet Buster</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Rodder</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Scaffold Erector</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Scale Person</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Sloper (Over 20&quot;)</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Sloper Sprayer</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Spreader (Concrete)</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Stake Hopper</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Stock Piler</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Swinging Stage/Boatswain Chair</td>
<td>$43.11</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Tamper &amp; Similar Electric, Air &amp; Gas Operated Tools</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tamper (Multiple &amp; Self-propelled)</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Timber Person - Sewer (Lagger, Shorer &amp; Cribber)</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Toolroom Person (at Jobsite)</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Topper</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Track Laborer</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Track Liner (Power)</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<td>Skagit Laborers</td>
<td>Traffic Control Laborer</td>
<td>$46.10</td>
<td>7A</td>
<td>4V</td>
<td>9C</td>
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<tr>
<td>Skagit Laborers</td>
<td>Traffic Control Supervisor</td>
<td>$46.10</td>
<td>7A</td>
<td>4V</td>
<td>9C</td>
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<td>Skagit Laborers</td>
<td>Truck Spotter</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tugger Operator</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 0-30 psi</td>
<td>$120.61</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 30.01-44.00 psi</td>
<td>$125.64</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
</tr>
<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 44.01-54.00 psi</td>
<td>$129.32</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 54.01-60.00 psi</td>
<td>$135.02</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 60.01-64.00 psi</td>
<td>$137.14</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
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<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 64.01-68.00 psi</td>
<td>$142.24</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 68.01-70.00 psi</td>
<td>$144.14</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 70.01-72.00 psi</td>
<td>$146.14</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Compressed Air Worker 72.01-74.00 psi</td>
<td>$148.14</td>
<td>7A</td>
<td>4V</td>
<td>9B</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Guage and Lock Tender</td>
<td>$52.54</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Tunnel Work-Miner</td>
<td>$52.54</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Vibrator</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<td>Skagit Laborers</td>
<td>Vinyl Seamer</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Watchman</td>
<td>$39.18</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Welder</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<td>Skagit Laborers</td>
<td>Well Point Laborer</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers</td>
<td>Window Washer/Cleaner</td>
<td>$39.18</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Laborers - Underground Sewer &amp; Water</td>
<td>General Laborer &amp; Topman</td>
<td>$50.86</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
</tr>
<tr>
<td>Skagit Laborers - Underground Sewer &amp; Water</td>
<td>Pipe Layer</td>
<td>$51.80</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Landscape Construction</td>
<td>Landscape Construction/Landscaping Or Planting Laborers</td>
<td>$39.18</td>
<td>7A</td>
<td>4V</td>
<td>8Y</td>
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<tr>
<td>Skagit Landscape Construction</td>
<td>Landscape Operator</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Skagit Landscape Maintenance</td>
<td>Groundskeeper</td>
<td>$14.18</td>
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<td>Skagit Lathers</td>
<td>Journey Level</td>
<td>$62.44</td>
<td>5D</td>
<td>1H</td>
<td>View</td>
</tr>
<tr>
<td>Skagit Marble Setters</td>
<td>Journey Level</td>
<td>$58.82</td>
<td>5A</td>
<td>1M</td>
<td>View</td>
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<tr>
<td>Skagit Metal Fabrication (In Shop)</td>
<td>Fitter</td>
<td>$15.16</td>
<td>1</td>
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<td>Skagit Metal Fabrication (In Shop)</td>
<td>Laborer</td>
<td>$13.50</td>
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<tr>
<td>Skagit Metal Fabrication (In Shop)</td>
<td>Machine Operator</td>
<td>$13.50</td>
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<tr>
<td>Skagit Metal Fabrication (In Shop)</td>
<td>Painter</td>
<td>$13.50</td>
<td>1</td>
<td>View</td>
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<tr>
<td>Skagit Metal Fabrication (In Shop)</td>
<td>Welder</td>
<td>$15.16</td>
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<td>Skagit Millwright</td>
<td>Journey Level</td>
<td>$63.94</td>
<td>7A</td>
<td>4C</td>
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<tr>
<td>Skagit Modular Buildings</td>
<td>Journey Level</td>
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<td>Skagit Painters</td>
<td>Journey Level</td>
<td>$43.40</td>
<td>6Z</td>
<td>2B</td>
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<td>Skagit</td>
<td><strong>Pile Driver</strong></td>
<td><strong>Crew Tender/Technician</strong></td>
<td>$67.31</td>
<td>7A</td>
<td>4C</td>
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<td>Skagit</td>
<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 0-30.00 PSI</strong></td>
<td>$77.93</td>
<td>7A</td>
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<td>Skagit</td>
<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 30.01 - 44.00 PSI</strong></td>
<td>$82.93</td>
<td>7A</td>
<td>4C</td>
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<td>Skagit</td>
<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 44.01 - 54.00 PSI</strong></td>
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<td>7A</td>
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<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 54.01 - 60.00 PSI</strong></td>
<td>$91.93</td>
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<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 60.01 - 64.00 PSI</strong></td>
<td>$94.43</td>
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<td>Skagit</td>
<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 64.01 - 68.00 PSI</strong></td>
<td>$99.43</td>
<td>7A</td>
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<td>Skagit</td>
<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 68.01 - 70.00 PSI</strong></td>
<td>$101.43</td>
<td>7A</td>
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<td>Skagit</td>
<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 70.01 - 72.00 PSI</strong></td>
<td>$103.43</td>
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<td>4C</td>
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<td>Skagit</td>
<td><strong>Pile Driver</strong></td>
<td><strong>Hyperbaric Worker - Compressed Air Worker 72.01 - 74.00 PSI</strong></td>
<td>$105.43</td>
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<td><strong>Pile Driver</strong></td>
<td><strong>Journey Level</strong></td>
<td>$62.69</td>
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<td>4C</td>
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<td>Skagit</td>
<td><strong>Plasterers</strong></td>
<td><strong>Journey Level</strong></td>
<td>$59.42</td>
<td>7Q</td>
<td>1R</td>
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<tr>
<td>Skagit</td>
<td><strong>Playground &amp; Park Equipment Installers</strong></td>
<td><strong>Journey Level</strong></td>
<td>$13.50</td>
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<tr>
<td>Skagit</td>
<td><strong>Plumbers &amp; Pipefitters</strong></td>
<td><strong>Journey Level</strong></td>
<td>$74.72</td>
<td>5A</td>
<td>1G</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Asphalt Plant Operators</strong></td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Assistant Engineer</strong></td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Barrier Machine (zipper)</strong></td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Batch Plant Operator: concrete</strong></td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Bobcat</strong></td>
<td>$65.05</td>
<td>7A</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Brokk - Remote Demolition Equipment</strong></td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Brooms</strong></td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Bump Cutter</strong></td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Cableways</strong></td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Chipper</strong></td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Compressor</strong></td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td><strong>Concrete Finish Machine - Laser Screed</strong></td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td></td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Equipment Type</td>
<td>Description</td>
<td>Rate</td>
<td>Skill Level</td>
<td>Hours</td>
<td>Pay Grade</td>
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<tr>
<td>Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure</td>
<td>$69.16 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Concrete Pump: Truck Mount With Boom Attachment Over 42 M</td>
<td>$68.55 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Concrete Pump: Truck Mount With Boom Attachment Up To 42m</td>
<td>$68.02 7A 3K 8X View</td>
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<tr>
<td>Cranes friction: 200 tons and over</td>
<td>$71.26 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Cranes: 100 tons through 199 tons, or 150’ of boom (including jib with attachments)</td>
<td>$69.85 7A 3K 8X View</td>
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<tr>
<td>Cranes: 20 Tons Through 44 Tons With Attachments</td>
<td>$68.55 7A 3K 8X View</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cranes: 200 tons- 299 tons, or 250’ of boom including jib with attachments</td>
<td>$70.57 7A 3K 8X View</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cranes: 300 tons and over or 300’ of boom including jib with attachments</td>
<td>$71.26 7A 3K 8X View</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cranes: 45 Tons Through 99 Tons, Under 150’ Of Boom (including Jib With Attachments)</td>
<td>$69.16 7A 3K 8X View</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cranes: A-frame - 10 Tons And Under</td>
<td>$65.05 7A 3K 8X View</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Cranes: Friction cranes through 199 tons</td>
<td>$70.57 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Cranes: through 19 tons with attachments, A-frame over 10 tons</td>
<td>$68.02 7A 3K 8X View</td>
<td></td>
<td></td>
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<tr>
<td>Crusher</td>
<td>$68.55 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Deck Engineer/Deck Winches (power)</td>
<td>$68.55 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Derricks, On Building Work</td>
<td>$69.16 7A 3K 8X View</td>
<td></td>
<td></td>
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<tr>
<td>Dozers D-9 &amp; Under</td>
<td>$68.02 7A 3K 8X View</td>
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<tr>
<td>Drill Oilers: Auger Type, Truck Or Crane Mount</td>
<td>$68.02 7A 3K 8X View</td>
<td></td>
<td></td>
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<tr>
<td>Drilling Machine</td>
<td>$69.85 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Elevator And Man-lift: Permanent And Shaft Type</td>
<td>$65.05 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Finishing Machine, Bidwell And Gamaco &amp; Similar Equipment</td>
<td>$68.55 7A 3K 8X View</td>
<td></td>
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<tr>
<td>Forklift: 3000 Lbs And Over With Attachments</td>
<td>$68.02 7A 3K 8X View</td>
<td></td>
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<tr>
<td>County</td>
<td>Position</td>
<td>Description</td>
<td>Rate</td>
<td>Column1</td>
<td>Column2</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Forklifts: Under 3000 Lbs. With Attachments</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Grade Engineer: Using Blue Prints, Cut Sheets, Etc</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Gradechecker/Stakeman</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Guardrail Punch</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Hard Tail End Dump Articulating Off-road Equipment 45 Yards. &amp; Over</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Horizontal/Directional Drill Locator</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Horizontal/Directional Drill Operator</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Hydralifts/Boom Trucks Over 10 Tons</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Hydralifts/Boom Trucks, 10 Tons And Under</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Loader, Overhead 8 Yards. &amp; Over</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Loader, Overhead, 6 Yards. But Not Including 8 Yards</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Loaders, Overhead Under 6 Yards</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Loaders, Plant Feed</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Loaders: Elevating Type Belt</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Locomotives, All</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Material Transfer Device</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Mechanics, All (leadmen - $0.50 Per Hour Over Mechanic)</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Motor Patrol Graders</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Oil Distributors, Blower Distribution &amp; Mulch Seeding Operator</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Outside Hoists (Elevators And Manlifts), Air Tuggers, Strato</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Overhead, Bridge Type Crane: 20 Tons Through 44 Tons</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Power Equipment Operators</strong></td>
<td>Overhead, Bridge Type: 100 Tons And Over</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Overhead, Bridge Type: 45 Tons Through 99 Tons</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Pavement Breaker</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Pile Driver (other Than Crane Mount)</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Plant Oiler - Asphalt, Crusher</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Posthole Digger, Mechanical</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Power Plant</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Pumps - Water</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
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<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Quad 9, Hd 41, D10 And Over</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Quick Tower - No Cab, Under 100 Feet In Height Based To Boom</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Remote Control Operator On Rubber Tired Earth Moving Equipment</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Rigger and Bellman</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Rigger/Signal Person, Bellman (Certified)</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Rollagon</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Roller, Other Than Plant Mix</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Roller, Plant Mix Or Multi-lift Materials</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Roto-mill, Roto-grinder</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Saws - Concrete</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Scraper, Self Propelled Under 45 Yards</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Scrapers - Concrete &amp; Carry All</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Scrapers, Self-propelled: 45 Yards And Over</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Service Engineers - Equipment</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Shotcrete/Gunite Equipment</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Shovel, Excavator, Backhoes: Over 90 Metric Tons</td>
<td>$70.57</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Slipform Pavers</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Spreader, Topsider &amp; Screedman</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Subgrader Trimmer</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Tower Bucket Elevators</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Tower Crane Up To 175' In Height Base To Boom</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Tower Crane: over 175' through 250' in height, base to boom</td>
<td>$70.57</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Tower Cranes: over 250' in height from base to boom</td>
<td>$71.26</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Transporters, All Track Or Truck Type</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Trenching Machines</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Truck Crane Oiler/driver - 100 Tons And Over</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Truck Crane Oiler/Driver Under 100 Tons</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Truck Mount Portable Conveyor</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Welder</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Wheel Tractors, Farmall Type</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators</td>
<td>Yo Yo Pay Dozer</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators - Underground Sewer &amp; Water</td>
<td>Asphalt Plant Operators</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators - Underground Sewer &amp; Water</td>
<td>Assistant Engineer</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators - Underground Sewer &amp; Water</td>
<td>Barrier Machine (zipper)</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators - Underground Sewer &amp; Water</td>
<td>Batch Plant Operator, Concrete</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators - Underground Sewer &amp; Water</td>
<td>Bobcat</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators - Underground Sewer &amp; Water</td>
<td>Brokk - Remote Demolition Equipment</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators - Underground Sewer &amp; Water</td>
<td>Brooms</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators - Underground Sewer &amp; Water</td>
<td>Bump Cutter</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cableways</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Chipper</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Compressor</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Concrete Finish Machine - Laser Screed</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Concrete Pump: Truck Mount With Boom Attachment Over 42 M</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Concrete Pump: Truck Mount With Boom Attachment Up To 42m</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Conveyors</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cranes friction: 200 tons and over</td>
<td>$71.26</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cranes: 100 tons through 199 tons, or 150’ of boom (including jib with attachments)</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cranes: 20 Tons Through 44 Tons With Attachments</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cranes: 200 tons- 299 tons, or 250’ of boom including jib with attachments</td>
<td>$70.57</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cranes: 300 tons and over or 300’ of boom including jib with attachments</td>
<td>$71.26</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cranes: 45 Tons Through 99 Tons, Under 150’ Of Boom (including Jib With Attachments)</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cranes: A-frame - 10 Tons And Under</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Cranes: Friction cranes through 199 tons</td>
<td>$70.57</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td></td>
<td></td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Operator Type</td>
<td>Description</td>
<td>Rate</td>
<td>Code</td>
<td>Code</td>
<td>Code</td>
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<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Crushers: through 19 tons with attachments, A-frame over 10 tons</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Deck Engineer/Deck Winches (power)</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Derricks, On Building Work</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Dozers D-9 &amp; Under</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Drill Oilers: Auger Type, Truck Or Crane Mount</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Drilling Machine</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Elevator And Man-lift: Permanent And Shaft Type</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Finishing Machine, Bidwell And Gamaco &amp; Similar Equipment</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Forklift: 3000 Lbs And Over With Attachments</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Forklifts: Under 3000 Lbs. With Attachments</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Grade Engineer: Using Blue Prints, Cut Sheets, Etc</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Gradechecker/Stakeman</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Guardrail Punch</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. &amp; Over</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>Horizontal/Directional Drill Locator</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td><strong>Skagit</strong></td>
<td><strong>Power Equipment Operators- Underground Sewer &amp; Water</strong></td>
<td>F</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Horizontal/Directional Drill Operator</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Hydralifts/Boom Trucks Over 10 Tons</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Hydralifts/Boom Trucks, 10 Tons And Under</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Loader, Overhead 8 Yards. &amp; Over</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Loader, Overhead, 6 Yards. But Not Including 8 Yards</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Loaders, Overhead Under 6 Yards</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Loaders, Plant Feed</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Loaders: Elevating Type Belt</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Locomotives, All</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Material Transfer Device</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Mechanics, All (leadmen - $0.50 Per Hour Over Mechanic)</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Motor Patrol Graders</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Oil Distributors, Blower Distribution &amp; Mulch Seeding Operator</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Outside Hoists (Elevators And Manlifts), Air Tuggers, Strato</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Overhead, Bridge Type Crane: 20 Tons Through 44 Tons</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Overhead, Bridge Type: 100 Tons And Over</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Overhead, Bridge Type: 45 Tons Through 99 Tons</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>State</td>
<td>Skill</td>
<td>Equipment Type</td>
<td>Rate</td>
<td>Scale</td>
<td>Grade</td>
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<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Pavement Breaker</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Pile Driver (other Than Crane Mount)</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Plant Oiler - Asphalt, Crusher</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Posthole Digger, Mechanical</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Power Plant</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Pumps - Water</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Quad 9, Hd 41, D10 And Over</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Quick Tower - No Cab, Under 100 Feet In Height Based To Boom</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Rigger and Bellman</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Rigger/Signal Person, Bellman (Certified)</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
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<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Rollagon</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Roller, Other Than Plant Mix</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Roller, Plant Mix Or Multi-lift Materials</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Roto-mill, Roto-grinder</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Saws - Concrete</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Scraper, Self Propelled Under 45 Yards</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Operation Type</td>
<td>Wage Rate</td>
<td>ICA</td>
<td>CBA</td>
<td>JCA</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Scrapers - Concrete &amp; Carry All</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Scrapers, Self-propelled: 45 Yards And Over</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Service Engineers - Equipment</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Shotcrete/Gunite Equipment</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
</tr>
<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Shovel, Excavator, Backhoes: Over 90 Metric Tons</td>
<td>$70.57</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Slipform Pavers</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
</tr>
<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Spreader, Topsider &amp; Screedman</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
</tr>
<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Subgrader Trimmer</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
</tr>
<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Tower Bucket Elevators</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
</tr>
<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Tower Crane Up To 175' In Height Base To Boom</td>
<td>$69.85</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
</tr>
<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Tower Crane: over 175’ through 250’ in height, base to boom</td>
<td>$70.57</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
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<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Tower Cranes: over 250’ in height from base to boom</td>
<td>$71.26</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
</tr>
<tr>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Transporters, All Track Or Truck Type</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
<td>8X</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Trenching Machines</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
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<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Truck Crane Oiler/driver - 100 Tons And Over</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Truck Crane Oiler/Driver Under 100 Tons</td>
<td>$68.02</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Truck Mount Portable Conveyor</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Welder</td>
<td>$69.16</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Wheel Tractors, Farmall Type</td>
<td>$65.05</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Equipment Operators- Underground Sewer &amp; Water</td>
<td>Yo Yo Pay Dozer</td>
<td>$68.55</td>
<td>7A</td>
<td>3K</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Line Clearance Tree Trimmers</td>
<td>Journey Level In Charge</td>
<td>$50.96</td>
<td>5A</td>
<td>4A</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Line Clearance Tree Trimmers</td>
<td>Spray Person</td>
<td>$48.35</td>
<td>5A</td>
<td>4A</td>
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<tr>
<td>Skagit</td>
<td>Power Line Clearance Tree Trimmers</td>
<td>Tree Equipment Operator</td>
<td>$50.96</td>
<td>5A</td>
<td>4A</td>
</tr>
<tr>
<td>Skagit</td>
<td>Power Line Clearance Tree Trimmers</td>
<td>Tree Trimmer</td>
<td>$45.54</td>
<td>5A</td>
<td>4A</td>
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<tr>
<td>Skagit</td>
<td>Power Line Clearance Tree Trimmers</td>
<td>Tree Trimmer Groundperson</td>
<td>$34.51</td>
<td>5A</td>
<td>4A</td>
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<tr>
<td>Skagit</td>
<td>Refrigeration &amp; Air Conditioning Mechanics</td>
<td>Journey Level</td>
<td>$74.71</td>
<td>5A</td>
<td>1G</td>
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<tr>
<td>Skagit</td>
<td>Residential Brick Mason</td>
<td>Journey Level</td>
<td>$32.30</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td>Residential Carpenters</td>
<td>Journey Level</td>
<td>$23.34</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td>Residential Cement Masons</td>
<td>Journey Level</td>
<td>$20.67</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td>Residential Drywall Applicators</td>
<td>Journey Level</td>
<td>$46.43</td>
<td>7A</td>
<td>4C</td>
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<tr>
<td>Skagit</td>
<td>Residential Drywall Tapers</td>
<td>Journey Level</td>
<td>$34.10</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td>Residential Electricians</td>
<td>Journey Level</td>
<td>$34.22</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td>Residential Glaziers</td>
<td>Journey Level</td>
<td>$44.15</td>
<td>7L</td>
<td>1H</td>
</tr>
<tr>
<td>Skagit</td>
<td>Residential Insulation Applicators</td>
<td>Journey Level</td>
<td>$18.03</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td>Residential Laborers</td>
<td>Journey Level</td>
<td>$20.98</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td>Residential Marble Setters</td>
<td>Journey Level</td>
<td>$32.30</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td>Residential Painters</td>
<td>Journey Level</td>
<td>$17.05</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td>Residential Plumbers &amp; Pipefitters</td>
<td>Journey Level</td>
<td>$46.23</td>
<td>5A</td>
<td>1G</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Residential Refrigeration &amp; Air Conditioning Mechanics</strong></td>
<td>Journey Level</td>
<td>$43.34</td>
<td>5A</td>
<td>1G</td>
</tr>
<tr>
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<tr>
<td>Skagit</td>
<td><strong>Residential Sheet Metal Workers</strong></td>
<td>Journey Level</td>
<td>$27.01</td>
<td></td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Residential Soft Floor Layers</strong></td>
<td>Journey Level</td>
<td>$30.31</td>
<td></td>
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<tr>
<td>Skagit</td>
<td><strong>Residential Sprinkler Fitters (Fire Protection)</strong></td>
<td>Journey Level</td>
<td>$32.87</td>
<td></td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Residential Stone Masons</strong></td>
<td>Journey Level</td>
<td>$32.30</td>
<td></td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Residential Terrazzo Workers</strong></td>
<td>Journey Level</td>
<td>$32.30</td>
<td></td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Residential Terrazzo/Terrazzo Finishers</strong></td>
<td>Journey Level</td>
<td>$35.85</td>
<td></td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Residential Tile Setters</strong></td>
<td>Journey Level</td>
<td>$32.30</td>
<td></td>
<td>1</td>
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<td>Skagit</td>
<td><strong>Roofers</strong></td>
<td>Journey Level</td>
<td>$31.84</td>
<td></td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Sheet Metal Workers</strong></td>
<td>Journey Level (Field or Shop)</td>
<td>$75.25</td>
<td>7F</td>
<td>1E</td>
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<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Boilermaker</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Carpenter</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Crane Operator</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Electrician</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Heat &amp; Frost Insulator</td>
<td>$76.61</td>
<td>5J</td>
<td>4H</td>
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<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Laborer</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Machinist</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Operating Engineer</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
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<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Painter</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Pipefitter</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Rigger</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
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<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Sheet Metal</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Shipfitter</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Warehouse/Teamster</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Shipbuilding &amp; Ship Repair</strong></td>
<td>New Construction Welder / Burner</td>
<td>$36.36</td>
<td>7V</td>
<td>1</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Ship Repair Boilermaker</strong></td>
<td></td>
<td>$46.15</td>
<td>7X</td>
<td>4J</td>
</tr>
<tr>
<td>Skagit</td>
<td><strong>Ship Repair Carpenter</strong></td>
<td></td>
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Overtime Codes

Overtime calculations are based on the hourly rate actually paid to the worker. On public works projects, the hourly rate must be not less than the prevailing rate of wage minus the hourly rate of the cost of fringe benefits actually provided for the worker.

1. **ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.**

   B. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   C. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   D. The first two (2) hours before or after a five-eight (5/8) hour workweek day or a four-ten (10/4) hour workweek day and the first eight (8) hours worked the next day after either work week shall be paid at one and one-half times the hourly rate of wage. All additional hours worked and all worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

   G. The first ten (10) hours worked on Saturdays and the first ten (10) hours worked on a fifth calendar weekday in a four-ten hour schedule, shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   H. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions or equipment breakdown) shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   I. All hours worked on Sundays and holidays shall also be paid at double the hourly rate of wage.

   J. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage.

   K. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

   M. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   N. All hours worked on Saturdays (except makeup days) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
Overtime Codes Continued

1. O. The first ten (10) hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays, holidays and after twelve (12) hours, Monday through Friday and after ten (10) hours on Saturday shall be paid at double the hourly rate of wage.

P. All hours worked on Saturdays (except makeup days if circumstances warrant) and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

Q. The first two (2) hours after eight (8) regular hours Monday through Friday and up to ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays (except Christmas day) shall be paid at double the hourly rate of wage. All hours worked on Christmas day shall be paid at two and one-half times the hourly rate of wage.

R. All hours worked on Sundays and holidays shall be paid at two times the hourly rate of wage.

S. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays and all other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays (except Labor Day) shall be paid at two times the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

V. All hours worked on Sundays and holidays (except Thanksgiving Day and Christmas day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Thanksgiving Day and Christmas day shall be paid at double the hourly rate of wage.

W. All hours worked on Saturdays and Sundays (except make-up days due to conditions beyond the control of the employer) shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

X. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage. When holiday falls on Saturday or Sunday, the day before Saturday, Friday, and the day after Sunday, Monday, shall be considered the holiday and all work performed shall be paid at double the hourly rate of wage.

Y. All hours worked outside the hours of 5:00 am and 5:00 pm (or such other hours as may be agreed upon by any employer and the employee) and all hours worked in excess of eight (8) hours per day (10 hours per day for a 4 x 10 workweek) and on Saturdays and holidays (except labor day) shall be paid at one and one-half times the hourly rate of wage. (except for employees who are absent from work without prior approval on a scheduled workday during the workweek shall be paid at the straight-time rate until they have worked 8 hours in a day (10 in a 4 x 10 workweek) or 40 hours during that workweek.) All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and Labor Day shall be paid at double the hourly rate of wage.

Z. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid the straight time rate of pay in addition to holiday pay.
Overtime Codes Continued

2. **ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.**

   B. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

   C. All hours worked on Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at two times the hourly rate of wage.

   F. The first eight (8) hours worked on holidays shall be paid at the straight hourly rate of wage in addition to the holiday pay. All hours worked in excess of eight (8) hours on holidays shall be paid at double the hourly rate of wage.

   G. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.

   H. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

   O. All hours worked on Sundays and holidays shall be paid at one and one-half times the hourly rate of wage.

   R. All hours worked on Sundays and holidays and all hours worked over sixty (60) in one week shall be paid at double the hourly rate of wage.

   U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked over 12 hours in a day or on Sundays and holidays shall be paid at double the hourly rate of wage.

   W. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The first eight (8) hours worked on the fifth day shall be paid at one and one-half times the hourly rate of wage. All other hours worked on the fifth, sixth, and seventh days and on holidays shall be paid at double the hourly rate of wage.

3. **ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.**

   A. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal shift, and all work on Saturdays shall be paid at time and one-half the straight time rate. Hours worked over twelve hours (12) in a single shift and all work performed after 6:00 pm Saturday to 6:00 am Monday and holidays shall be paid at double the straight time rate of pay. Any shift starting between the hours of 6:00 pm and midnight shall receive an additional one dollar ($1.00) per hour for all hours worked that shift. The employer shall have the sole discretion to assign overtime work to employees. Primary consideration for overtime work shall be given to employees regularly assigned to the work to be performed on overtime situations. After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

   C. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays shall be paid at double the hourly rate of wage. After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.
3. E. All hours worked Sundays and holidays shall be paid at double the hourly rate of wage. Each week, once 40 hours of straight time work is achieved, then any hours worked over 10 hours per day Monday through Saturday shall be paid at double the hourly wage rate.

F. All hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.

H. All work performed on Sundays between March 16th and October 14th and all Holidays shall be compensated for at two (2) times the regular rate of pay. Work performed on Sundays between October 15th and March 15th shall be compensated at one and one half (1-1/2) times the regular rate of pay.

J. All hours worked between the hours of 10:00 pm and 5:00 am, Monday through Friday, and all hours worked on Saturdays shall be paid at a one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

K. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the eight (8) hours rest period.

4. **ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.**

   A. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage.

   B. All hours worked over twelve (12) hours per day and all hours worked on holidays shall be paid at double the hourly rate of wage.

   C. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay. On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay. All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.
Overtime Codes Continued

4. **D.** All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturday, Sundays and holidays shall be paid at double the hourly rate of pay. Rates include all members of the assigned crew.

**EXCEPTION:**
On all multipole structures and steel transmission lines, switching stations, regulating, capacitor stations, generating plants, industrial plants, associated installations and substations, except those substations whose primary function is to feed a distribution system, will be paid overtime under the following rates:

The first two (2) hours after eight (8) regular hours Monday through Friday of overtime on a regular workday, shall be paid at one and one-half times the hourly rate of wage. All hours in excess of ten (10) hours will be at two (2) times the hourly rate of wage. The first eight (8) hours worked on Saturday will be paid at one and one-half (1-1/2) times the hourly rate of wage. All hours worked in excess of eight (8) hours on Saturday, and all hours worked on Sundays and holidays will be at the double the hourly rate of wage.

All overtime eligible hours performed on the above described work that is energized, shall be paid at the double the hourly rate of wage.

5. **E.** The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one and one half (1½) times the regular shift rate for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

6. **F.** All hours worked between the hours of 6:00 pm and 6:00 am, Monday through Saturday, shall be paid at a premium rate of 20% over the hourly rate of wage. All hours worked on Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

7. **G.** All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

8. **H.** The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, and all hours on Sunday shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

9. **I.** The First eight (8) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) per day on Saturdays shall be paid at double the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

10. **J.** The first eight (8) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) hours on a Saturday shall be paid at double the hourly rate of wage. All hours worked over twelve (12) in a day, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

11. **K.** All hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage, so long as Saturday is the sixth consecutive day worked. All hours worked over twelve (12) in a day Monday through Saturday, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.
4. **L.** The first twelve (12) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on a Saturday in excess of twelve (12) hours shall be paid at double the hourly rate of pay. All hours worked over twelve (12) in a day Monday through Friday, and all hours worked on Sundays shall be paid at double the hourly rate of wage. All hours worked on a holiday shall be paid at one and one-half times the hourly rate of wage, except that all hours worked on Labor Day shall be paid at double the hourly rate of pay.

**M.** All hours worked on Sunday and Holidays shall be paid at double the hourly rate. Any employee reporting to work less than nine (9) hours from their previous quitting time shall be paid for such time at time and one-half times the hourly rate.

**N.** All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays, and all work performed between the hours of midnight (12:00 AM) and eight AM (8:00 AM) every day shall be paid at double the hourly rate of wage.

**O.** All hours worked between midnight Friday to midnight Sunday shall be paid at one and one-half the hourly rate of wage. After an employee has worked in excess of eight (8) continuous hours in any one or more calendar days, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of six (6) hours or more. All hours worked on Holidays shall be paid at double the hourly rate of wage.

**P.** All hours worked on Holidays shall be paid at one and one-half times the hourly rate of wage.

**Q.** The first four (4) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday shall be paid at double the hourly rate. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

**R.** All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage, so long as Saturday is the sixth consecutive day worked. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

**S.** All hours worked on Saturdays and Holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays shall be paid at double the hourly rate of wage.

**T.** The first two (2) hours of overtime for hours worked Monday-Friday shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day shall be paid at double the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. For work on Saturday which is scheduled prior to the end of shift on Friday, the first six (6) hours work shall be paid at one and one-half times the hourly rate of wage, and all hours over (6) shall be paid double the hourly rate of wage. For work on Saturday which was assigned following the close of shift on Friday, all work shall be paid at double the hourly rate of wage.

**U.** The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. (Except on makeup days if work is lost due to inclement weather, then the first eight (8) hours on Saturday may be paid the regular rate.) All hours worked over twelve (12) hours Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.
4. **V.** Work performed in excess of ten (10) hours of straight time per day when four ten (10) hour shifts are established or outside the normal shift (5 am to 6pm), and all work on Saturdays, except for make-up days shall be paid at time and one-half (1 ½) the straight time rate.

In the event the job is down due to weather conditions, then Saturday may, be worked as a voluntary make-up day at the straight time rate. However, Saturday shall not be utilized as a make-up day when a holiday falls on Friday. All work performed on Sundays and holidays and work in excess of twelve (12) hours per day shall be paid at double (2x) the straight time rate of pay.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

**W.** All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

**X.** All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. Work performed outside the normal shift of 6 am to 6pm shall be paid at one and one-half the straight time rate, (except for special shifts or three shift operations). All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. Shifts may be established when considered necessary by the Employer.

The Employer may establish shifts consisting of eight (8) or ten (10) hours of work (subject to WAC 296-127-022), that shall constitute a normal forty (40) hour work week. The Employer can change from a 5-eight to a 4-ten hour schedule or back to the other. All hours of work on these shifts shall be paid for at the straight time hourly rate. Work performed in excess of eight hours (or ten hours per day (subject to WAC 296-127-022) shall be paid at one and one-half the straight time rate.

When due to conditions beyond the control of the Employer, or when contract specifications require that work can only be performed outside the regular day shift, then by mutual agreement a special shift may be worked at the straight time rate, eight (8) hours work for eight (8) hours pay. The starting time shall be arranged to fit such conditions of work.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.
4. Y. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal shift, and all work on Saturdays shall be paid at time and one-half the straight time rate. All work performed after 6:00 pm Saturday to 6:00 am Monday and holidays shall be paid at double the straight time rate of pay.

Any shift starting between the hours of 6:00 pm and midnight shall receive an additional one dollar ($1.00) per hour for all hours worked that shift.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

**Holiday Codes**


### Holiday Codes Continued

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>Z.</td>
<td>Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). If a holiday falls on Saturday, the preceding Friday shall be considered as the holiday. If a holiday falls on Sunday, the following Monday shall be considered as the holiday.</td>
</tr>
<tr>
<td>7 A.</td>
<td>Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any Holiday Which Falls On A Sunday Shall Be Observed As A Holiday On The Following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.</td>
</tr>
<tr>
<td>B.</td>
<td>Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.</td>
</tr>
<tr>
<td>C.</td>
<td>Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.</td>
</tr>
</tbody>
</table>
Holiday Codes Continued


E. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

F. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the last working day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.


H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

J. Holidays: New Year's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

L. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Last Work Day before Christmas Day, and Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

M. Paid Holidays: New Year's Day, The Day after or before New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the Day after or before Christmas Day (10). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. When Christmas falls on a Saturday, the preceding Friday shall be observed as a holiday.


Holiday Codes Continued

7. Q. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

R. Paid Holidays: New Year's Day, the day after or before New Year’s Day, President’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day after or before Christmas Day (10). If any of the listed holidays fall on Saturday, the preceding Friday shall be observed as the holiday. If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

S. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, the Day after Christmas, and A Floating Holiday (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

T. Paid Holidays: New Year's Day, the Day after or before New Year’s Day, President’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and The Day after or before Christmas Day. (10). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

V. Holidays: New Year's Day, President’s Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the day before or after Christmas, and the day before or after New Year’s Day. If any of the above listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

W. Holidays: New Year's Day, Day After New Year’s, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, Christmas Day, the day after Christmas, the day before New Year’s Day, and a Floating Holiday.

X. Holidays: New Year's Day, Presidents’ Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the day before or after Christmas, and the day before or after New Year’s Day. If a holiday falls on a Saturday or on a Friday that is the normal day off, then the holiday will be taken on the last normal workday. If the holiday falls on a Monday that is the normal day off or on a Sunday, then the holiday will be taken on the next normal workday.

Y. Holidays: New Year's Day, Presidents’ Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. (8) If the holiday falls on a Sunday, then the day observed by the federal government shall be considered a holiday and compensated accordingly.

Z. Holidays: New Year's Day, President’s Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

15. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the day before Christmas Day and Christmas Day. (8) Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.


Holiday Codes Continued


Note Codes

8. D. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $0.75, Level B: $0.50, And Level C: $0.25.

M. Workers on hazmat projects receive additional hourly premiums as follows: Levels A & B: $1.00, Levels C & D: $0.50.

N. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.

P. Workers on hazmat projects receive additional hourly premiums as follows -Class A Suit: $2.00, Class B Suit: $1.50, Class C Suit: $1.00, And Class D Suit $0.50.

Q. The highest pressure registered on the gauge for an accumulated time of more than fifteen (15) minutes during the shift shall be used in determining the scale paid.

S. Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

T. Effective August 31, 2012 – A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

U. Workers on hazmat projects receive additional hourly premiums as follows – Class A Suit: $2.00, Class B Suit: $1.50, And Class C Suit: $1.00. Workers performing underground work receive an additional $0.40 per hour for any and all work performed underground, including operating, servicing and repairing of equipment. The premium for underground work shall be paid for the entire shift worked. Workers who work suspended by a rope or cable receive an additional $0.50 per hour. The premium for work suspended shall be paid for the entire shift worked. Workers who do “pioneer” work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation receive an additional $0.50 per hour.
In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.

Depth premiums apply to depths of fifty feet or more. Over 50’ to 100’ - $2.00 per foot for each foot over 50 feet. Over 101’ to 150’ - $3.00 per foot for each foot over 101 feet. Over 151’ to 220’ - $4.00 per foot for each foot over 220 feet. Over 221’ - $5.00 per foot for each foot over 221 feet.

Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25’ to 300’ - $1.00 per foot from entrance. 300’ to 600’ - $1.50 per foot beginning at 300’. Over 600’ - $2.00 per foot beginning at 600’.

Meter Installers work on single phase 120/240V self-contained residential meters. The Lineman/Groundmen rates would apply to meters not fitting this description.

Workers on hazmat projects receive additional hourly premiums as follows - Class A Suit: $2.00, Class B Suit: $1.50, Class C Suit: $1.00, and Class D Suit: $0.50. Special Shift Premium: Basic hourly rate plus $2.00 per hour.

When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications requires that work can only be performed outside the normal 5 am to 6pm shift, then the special shift premium will be applied to the basic hourly rate. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in OT or Double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.

Swinging Stage/Boatswains Chair: Employees working on a swinging state or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as a contractor), a government agency or the contract specifications require that more than (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they will be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)
9. A. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications require that more than four (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Certified Crane Operator Premium: Crane operators requiring certifications shall be paid $0.50 per hour above their classification rate.

Boom Pay Premium: All cranes including tower shall be paid as follows based on boom length:

(A) – 130’ to 199’ – $0.50 per hour over their classification rate.
(B) – 200’ to 299’ – $0.80 per hour over their classification rate.
(C) – 300’ and over – $1.00 per hour over their classification rate.

B. The highest pressure registered on the gauge for an accumulated time of more than fifteen (15) minutes during the shift shall be used in determining the scale paid.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

C. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. These classifications are only effective on or after August 31, 2012.

D. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, bridges, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

E. Heavy Construction includes construction, repair, alteration or additions to the production, fabrication or manufacturing portions of industrial or manufacturing plants, hydroelectric or nuclear power plants and atomic reactor construction. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Procedures for preparation and submittal of the Schedule of Values.

1.02 SUBMITTALS

A. Contractor shall submit an initial Schedule of Values per the Pre-Construction Submittal Requirements of Section 01 33 00.

B. Contractor shall submit supporting documentation justifying the amounts in the Schedule of Values if requested by Owner.

1.03 SCHEDULE OF VALUES

A. Contractor shall submit a typed schedule on Owner’s form. Once approved, Contractor shall not revise the Schedule of Values without prior approval by Owner.

B. Format:

1. Separate each category of Work into a separate line item.

2. List all major Work activities indicated on the Progress Schedule.

3. Separate floors, phases, and other easily recognized building divisions when appropriate.

4. Separate labor, materials and equipment for each item.

5. Identify site mobilization, demobilization, bonds, and insurance as individual line items.

6. Include a line item for close-out Work between Substantial Completion and Final Completion.

7. If applicable, include a line item for allowances. For unit cost allowances, give quantities measured from the Contract Documents multiplied by the unit cost.

8. When required by Owner, include separate line items for “separately funded Work.”

END OF SECTION 01 29 73
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preconstruction Meeting;
   2. Progress Meetings; and
   3. Other meetings, as requested by Owner.

1.02 PRECONSTRUCTION MEETING

A. Meeting Location: Owner will schedule a meeting prior to the start of construction. The purpose of this meeting is to review Contract administration requirements and mobilization procedures. Attendance is required for the following:

   1. Architect/Engineer and design Subconsultants;
   2. Contractor’s Superintendent and Project Manager;
   3. Representative of major Subcontractors, as appropriate;
   4. Others, as appropriate.

B. Owner’s Designated Representative shall:

   1. Preside over and conduct meeting.
   2. Record, reproduce, and distribute copies of minutes within 7 Days of the meeting to all meeting participants.

C. Agenda for the meeting will include at a minimum:

   1. The Work;
   2. Progress Schedule, including Work sequence, phasing, and occupancy requirements;
   3. Communications chain and persons authorized to direct changes;
   4. Use of the Project site;
   5. Special Project procedures;
   6. Procedures and processing:
      a. Application for Payments and Schedule of Values;
      b. Contract Change Proposals (CCP), Work Directive (WD);
      c. Change Orders (CO);
d. Requests for Information (RFI);
e. Submittals; and
f. Others as appropriate.

7. Project Record;
8. Construction facilities, controls, and construction aids;
9. Temporary utilities;
10. Security procedures;
11. Safety and first-aid procedures;
12. Environmental Health and Safety;
13. Housekeeping procedures;
14. AHJ representative(s) and inspection procedures;
15. Utility shutdowns;
16. Parking;
17. Existing conditions;
18. Subcontractor list;
19. Emergency phone and keys to site;
20. Progress meeting scheduling;
21. Shipment and deliveries; and
22. Other(s) as appropriate.

1.03 PROGRESS MEETINGS

A. Progress meetings will occur weekly.

B. Meeting Location: Contractor's Project field office, unless otherwise agreed.

C. Attendance: Representatives attending meetings must be qualified and authorized to act on behalf of their firms. Attendance shall include:

1. Architect/Engineer and Subconsultants, as appropriate;
2. Owner's Designated Representatives;
3. Contractor's Superintendent and Project Manager;
4. Subcontractors, as appropriate;
5. Suppliers, as appropriate; and
6. Others, as appropriate.
D. Owner’s Designated Representative shall:

1. Administer progress and other specially scheduled meetings;
2. Record, reproduce, and distribute copies of minutes within 6 Days of meeting to all meeting participants; and

E. Contractor shall, at each meeting, provide each meeting attendant with:

1. Short-interval (look-ahead) schedule coordinated with the Progress Schedule;
2. Updated Progress Schedule, if appropriate;
3. Updated submittal log and schedules;
4. Updated RFI log;
5. Issues Log;
6. Quality Control Log; and
7. Any applicable tracking mechanisms.

F. Agenda for these meetings will include at a minimum:

1. Project safety;
2. Review and approval of minutes from previous meeting;
3. Review Work progress since previous meeting;
4. Review plans for progress for subsequent Work period and short-interval (look-ahead) schedule;
5. Review Progress Schedule;
6. Present corrective measures and procedures to regain Progress Schedule, as applicable;
7. Present field observations, problems, and conflicts;
8. Discuss RFIs;
9. Review quality control;
10. Review submittal log and schedules and present methods to expedite as required;
11. Review off-site fabrication;
12. Review delivery schedules;
13. Review coordination issues;
14. Review proposed changes for:
   a. Effect on Progress Schedule and on completion date.
   b. Effect on any other contracts of the Project.
15. Review Issues Log;
16. Review draft Application for Payment (at end of month);
17. Review Project Record; and
18. Review any other issues.

1.04 OTHER MEETINGS

A. Owner may call additional Project meetings as appropriate.

B. Meetings as required by other sections.

C. Format and agenda of these meetings will follow that of Progress Meetings unless Owner determines otherwise.

END OF SECTION 01 31 19
PART 1 GENERAL

1.01 GENERAL COMMUNICATION

A. Subcontractors: Informal communication between Owner, Owner's consultants, and other Subcontractors is permitted. If written clarification or direction is required to resolve questions, transmit questions in writing using a Request for Information (RFI) through the Contractor to Owner.

B. In case of an EMERGENCY, dial 9-1-1 if appropriate; otherwise, contact Owner's Designated Representative. If he or she is not available contact Facilities Services, Capital at 509-335-9000.

1.02 CORRESPONDENCE

A. Address all correspondence to Owner's Designated Representative.

B. Contractor shall copy Architect/Engineer on all correspondence to and from Owner.

C. Include Project title and Owner Project number on all correspondence.

1.03 REQUEST FOR INFORMATION

A. When field conditions or Contract Document require clarification, a written Request for Information (RFI) must be submitted per the following:

1. Identify the nature and location of each clarification/verification using a RFI form and provide at least the following information:
   a. Project name and number;
   b. Date;
   c. Date response requested;
   d. RFI number;
   e. Subject;
   f. Initiator of the question;
   g. Indication of costs;
   h. Indication of schedule impact;
   i. Location on site;
   j. Contract Drawing reference;
   k. Contract Specification section and paragraph reference;
   l. Descriptive text;
   m. Recommended solution(s); and
n. Space for reply on same page as questions.

B. Each RFI must be limited to a single issue, but shall reference other related RFI’s.

C. Route and copy RFIs in same manner as correspondence.

D. Allow a minimum of 14 Days for Owner response to RFI.

1.04 NONCONFORMANCE REPORT


B. Procedure: If Contractor proceeds to install deficient Work or fails to correct Work that in the opinion of Owner fails to conform to the Contract Documents, an NCR may be issued. Upon receipt of a NCR, Contractor shall take immediate action to correct nonconforming Work. Correction of nonconforming Work will be reviewed at progress meetings.

1.05 COORDINATION

A. Special Coordination:

1. East campus entry off State Route 536 shall remain open except for temporary closures coordinated a minimum of 72 hours in advance and approved by the University. At the sole discretion of the University, closures of this entrance may be denied during University events open to the public. Any closure of the east entrance will also need to be coordinated with Skagit County Fire District 2 to determine an acceptable alternate fire access.

2. Contractor parking is allowed in the nine (9) paved spaces on the east end of the parking lot and in the gravel area between the construction site and the Tree House.

3. Laydown area is designated in the grass area immediately south of the construction site.

4. Construction activities may be limited during major campus events open to the public. In particular, construction activities shall not occur during the Field Day on July 9 beginning at 3:00pm.

5. Utility shutdowns will need to be coordinated with the University in advance. Power and water shutdowns shall be limited in duration due to the critical need for irrigation and greenhouse cooling during the growing season.

6. Due to the adjacent residential properties, noisy work shall not occur before 7:00am.
B. General Coordination: Contractor shall:

1. Coordinate with Work of other sections to ensure that all fixtures, devices, switches, outlets, ducts, pipes, and similar items can be installed as shown without modifications to framing. Provide all blockouts, raceways and similar framing, as required;

2. Coordinate the Work and not delegate responsibility for coordination to any Subcontractor. Contractor must make available to each Subcontractor, prior to the execution of each Subcontract, copies of the Contract Documents to which the Subcontractor will be bound. Subcontractor will similarly make copies of the Contract Documents available to their respective lower-tier Subcontractors. Contractor must provide Owner copies of the written agreements between Contractor and any Subcontractor upon request;

3. Anticipate interrelationship of all Subcontractors and their relationship with the total Work;

4. Resolve differences or disputes between Subcontractors and materials suppliers concerning coordination, interference, or extent of Work between sections;

5. Be in charge of and responsible for the Work and the Project site, including directing and scheduling all Work; and

6. Cooperate with Separate Contractors. Work by others may be occurring within the building or at locations adjacent or near to the Project site. Contractor must cooperate with all such work.

C. Mechanical and Electrical Coordination: Contractor shall:

1. Resolve all “tight”, restricted, or inaccessible areas involving Work of various disciplines in advance of installation.

2. If necessary, and before Work proceeds in these areas, prepare coordination drawings for review showing all Work in “tight”, restricted, or inaccessible areas.

3. Provide coordination drawings necessary to resolve “tight”, restricted, or inaccessible areas, at no increase in Contract Sum.

D. Job Site Field Measurements and Templates: Contractor shall:

1. Obtain field measurements required for accurate fabrication and installation of Work. Exact measurements are Contractor’s responsibility.

2. Furnish or obtain templates, patterns, and setting instructions as required for installation of all Work. Contractor shall verify in field, as needed.

END OF SECTION 01 31 23
PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the administrative and procedural requirements to comply with the requirements of the General Conditions regarding preparation of Contractor's Progress Schedules, monthly update to the Progress Schedules, and other schedules as specified herein. The purposes of these schedules and reports are to:

1. Ensure adequate planning and execution of the Work by Contractor;
2. Establish a standard against which progress of the Work can be tracked;
3. Assist in monitoring progress;
4. Evaluate the impact of any changes to the Contract; and
5. Support the basis for progress payments.

B. All schedule submittals including updated Progress Schedules will be reviewed by Owner for compliance with Contract terms and the needs of the University. Review of any schedule does not constitute approval or acceptance of Contractor's construction means, methods, or sequencing, or an assessment by Owner of Contractor's ability to complete the Work within the Contract Time.

1.02 WORK INCLUDED

A. Contractor shall submit a preliminary Progress Schedule, as required by the Pre-Construction Submittal Requirements of Section 01 33 00.

B. Contractor shall prepare and submit Progress Schedules and reports as required by this Section. NOTE: Processing and payment of the second Application for Payment is contingent upon receipt, review, and subsequent acceptance of the updated Progress Schedule.

C. Contractor shall participate in monthly scheduling meetings and provide updated Progress Schedules as require by this Section.

D. Contractor shall perform Contemporaneous Period Analysis (CPA) of any delays associated with the critical path schedule as required by this Section.

E. Contractor shall provide weekly Short-Interval (look-ahead) schedules as required by this Section.

F. Contractor shall submit a Submittal Schedule as required by this Section.

1.03 PRELIMINARY PROGRESS SCHEDULE

A. Contractor shall submit a preliminary Progress Schedule as part of the Pre-
Construction Submittal Requirements in Section 01 33 00 - Submittals. This preliminary Progress Schedule shall consist of a narrative description of the Work, a time-scaled logic diagram, and a tabular report identifying planned construction activities for the entire Work. Activities should be sufficiently detailed and no activity should be longer than 14 Days. Together these documents constitute the preliminary Progress Schedule. In the preliminary Progress Schedule, Contractor must emphasize milestone dates, the date of Substantial Completion, and the Work of separate contractors.

B. The preliminary Progress Schedule shall be prepared using the approved software program required by Part 2 of this Section. The time-scaled logic diagram and tabular report will provide similar data, but in an abbreviated form to that specified for the Contractor's Progress Schedule.

C. Contractor shall submit a narrative description of the Work for the 120 Day period following NTP that identifies the critical path and factors that might jeopardize the critical path, achievement of any major milestones, and any unusual circumstances or events upon which the preliminary Progress Schedule relies.

1.04 CONTRACTOR'S PROGRESS SCHEDULE

A. Contractor shall submit a detailed Progress Schedule within 30 Days of receiving Owner's comments on its preliminary Progress Schedule. This schedule shall be the Contractor's as-planned schedule and shall be used 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 schedule must clearly identify the critical path.

B. The Contractor shall submit a Progress Schedule for the entire Project with all specified tabular reports and electronic copies for review and comment, with 14 Days submittal review per 01 33 00.

C. The Progress Schedule shall be prepared to show the order in which the Contractor proposes to carry out the Work and to indicate any access or Work area restrictions and planned availability and use of manpower, materials, and equipment. The Progress Schedule must incorporate any Contract-specified limitations and restrictions, contractually specified milestones, and completion date(s). Contractor shall prepare the Progress Schedule in sufficient detail and in compliance with the following factors:

1. The Progress Schedule shall be based upon calendar days;
2. The Progress Schedule shall be based upon retained logic;
3. The Progress Schedule shall be organized into logical subnetworks;
4. The type of Work to be performed and labor trades involved shall be identified;
5. All procurement, manufacture, and delivery activities for all major materials and equipment shall be identified. All long lead items identified by submittal shall be included.;
6. Date(s) when Owner-furnished equipment and material is required;
7. Assignment and coding of all activities by the performing entity such as Subcontractors, Vendors, Owner, etc. must be included;
8. Access to and availability of the Work area shall be considered;
9. Identification of interfaces and dependencies with preceding, concurrent, and succeeding activities shall be indicated;
10. Testing, submission and approval of test results shall be identified;
11. Planning for phased occupancy by Owner, if applicable, shall be included;
12. Dates when approvals are required by regulatory agencies or other third parties shall be indicated;
13. In calculating activity durations, normal inclement weather must be considered;
14. Incorporate the Submittal Schedule; and
15. Contract-stipulated milestones and completion date(s) shall be included.

D. The activities defined in the Progress Schedule shall represent the planned durations in anticipation of normal manpower and equipment utilization in durations of whole working days. No activity durations or nonconstruction activities such as procurement, delivery or submittal activities shall exceed 14 Days unless approved by Owner. Contractor shall schedule the Work to minimize the potential effects of adverse weather. Contractor shall also protect the Project site from the effects of weather and take other necessary measures such that the Work can be completed within the time established in the Contract.

E. Scheduled activities shall be identified by a unique identifier, which shall remain consistent throughout the Project.

1. Activity Description: Provide adequate information to readily identify each activity.
2. The critical path must be clearly identified on all schedules.
3. Furnish a written narrative to explain how durations for critical activities were determined. Such explanation must include the number of crews, crew composition, number of shifts per day, number of hours in a shift, and number of Work days per week, as well as construction equipment and material quantities.
4. Logic constraints are disallowed unless a compelling reason exists for their use.
5. Clearly identify and provide a written narrative for all activities that are planned to be conditioned by use of overtime, double shifts, or work on weekends or holidays, whether critical or not.
6. Each submittal involving graphical and/or tabular reports produced shall be accompanied by a report, which includes an open-end listing, a listing of any out-of-sequence progress, identification of any constrained dates,
the schedule calculation mode (retained or logic override), and any other
statistics that are normally a part of such a report.

F. Contractor shall provide the following submittals with the initial schedule
submission, as applicable, and for each monthly update thereafter:

1. Detail Progress Schedule (baseline schedule);
2. Monthly updated Progress Schedules; and
The above submittals shall be transmitted electronically.

G. The Contractor shall submit the Progress Schedule, consisting of the reports and
diagrams as specified by this subsection, in the following formats quantities:

1. Electronic PDF file of all reports, schedules, etc.
2. Native electronic copy of the CPM Progress Schedule.

H. Float: Contractor is not entitled to any adjustment in the Contract Time or the
Contract Sum, or to any additional payment or equitable adjustment of any sort,
by reason of the loss or the use of any float time, including time between
Contractor’s anticipated completion date and the end of the Contract Time,
whether or not the float time is described as such on the Progress Schedule.

I. Qualifications: Contractor shall submit the resume(s) of the person(s) designated
as responsible for schedules and reports (the Contractor's scheduler) Prior to
commencing construction activities. Contractor's scheduler shall have
demonstrable capability to plan, coordinate, execute, and monitor a CPM
schedule as required for this Project. Owner's Designated Representative will
approve or disapprove the Contractor's proposed scheduler. In the event of
disapproval, a new scheduler shall be proposed within 7 Days and be subject to
the same consideration criteria as noted above.

1.05 MONTHLY UPDATES

A. Contractor shall prepare and submit updated Progress Schedules and participate
in schedule update meetings with the Owner each month. Participation in the
meeting and submission of the monthly update is a condition precedent for
payment of the line item value for scheduling Work.

1. Updated monthly schedule submittals:
   a. A PDF electronic version of complete Project schedule showing
      the critical path accompanied by a narrative of any deviations from
      the previous month.
   b. Electronic schedule file in native format.
   c. Short-interval schedules or look-ahead schedules shall not be an
      acceptable submittal.

B. Contractor shall prepare an update of the current Progress Schedule each month
to reflect Work progress achieved since the previous update. Progress updating shall be performed without changes to the schedule logic or the original duration of activities. Monthly progress updating is required and necessary prior to performing a Contemporaneous Period Analysis of any change to the calculated completion date from the prior update.

C. Contractor may, in a second report, incorporate any logic and duration changes that represent revised planning. All such changes must be clearly identified and submitted for acceptance.

D. The Progress Schedule must clearly identify the current Substantial and Final Completion dates.

E. Contractor shall account for all adverse weather days and similar excusable noncompensable delays. By whatever method Contractor chooses to account for such delays and events, a narrative description and CPA of the accounting shall be included with the narrative report.

F. Monthly schedule update meetings:

1. Monthly schedule update meetings shall be held at Contractor's Project field office one week prior to the due date of Contractor's monthly Application for Payment, unless otherwise agreed.

2. The Contractor shall provide updated Project schedule submittals.

3. The Contractor shall also provide a narrative report including:
   a. A description of the Work accomplished during the preceding period;
   b. A discussion of the Work that had been scheduled to be performed during the previous period but was not, and explain why it was not performed; and
   c. A discussion of the Work scheduled for the upcoming period noting any issues or events that could impact this Work. If Contractor intends to make logic or original activity duration changes, the report must specifically identify such changes.

4. Contractor, Owner, and Architect/Engineer will review these reports and will discuss any differences or issues raised. No contractual completion dates will be modified except by approved Change Order.

G. Timely submission of updates is of significant and crucial importance to the Project. Owner may withhold payment as per Section 01 29 00 Applications for Payment.

1.06 THE CONTEMPORANEOUS PERIOD ANALYSIS

A. It is Owner's intent to resolve all issues affecting the Contract completion date in a timely, efficient and effective manner. To achieve this goal, and in addition to contractor’s obligation to follow the contractual dispute resolution procedure,
Contractor shall analyze any delays to the critical path or completion date by application of the Contemporaneous Period Analysis method. A CPA shall normally coincide with the monthly schedule update meetings.

B. Assessment of impacts due to changes or other events, in accordance with the CPA method, must be based on the most recent accepted updated Progress Schedule. No logic or duration changes shall be made to updates until progress related data has been incorporated into the Progress Schedule and the Progress Schedule is updated to reflect actual progress for the period. All data shall be provided to Owner.

C. Submission of an accurate and properly updated Progress Schedule and completion of the Contemporaneous Period Analysis are conditions precedent to the review and approval of any request for an extension in the Contract Time. Owner may assess liquidated damages, if any, regardless of the status of any requests for time extensions pending, until any such requests are resolved.

D. The process for preparing and submitting a CPA is as follows:
   1. Contractor will notify Owner in writing of event(s) or occurrence(s) which constitute a delay of the critical path or completion date affecting progress of the Work.
   2. Contractor shall evaluate the event(s) or occurrence(s) and produce a narrative of the resulting delay describing the effect upon concurrent or logically connected subsequent activities.
   3. Consistent with the narrative, Contractor shall produce a subnet to graphically describe the event(s) or occurrence(s) and the effect upon the Progress Schedule.
   4. Contractor will recalculate the Progress Schedule and provide an updated PDF and Native Progress Schedule.

E. The CPA will be reviewed at the monthly schedule update meeting or at a special meeting scheduled with Owner. At the CPA review meeting, Contractor shall present the CPA and respond to questions.

F. Until and unless substantiated delay is accepted by Owner, the time effect shall not be incorporated into any monthly update. If accepted after a monthly update in which the event(s) or occurrence(s) took place, that monthly update may be recalculated, resubmitted and shall be included in an approved Change Order.

1.07 SHORT-INTERVAL SCHEDULE

A. Prepare a weekly Short-Interval (look-ahead) Schedule based upon the Contractor’s Work plan and the updated Progress Schedule.

B. Format for the Short-Interval (look-ahead) Schedule shall be acceptable to Owner. The format shall include comment annotation as necessary.
C. Content of the Short-Interval (look-ahead) Schedule shall include the Work planned for the next 3-week period and the Work that was performed in the previous week.

D. Copies of the Short-Interval (look-ahead) Schedule shall be provided at the weekly progress meetings to be used as a basis for discussion of progress and of planned Work.

1.08 SUBMITTAL SCHEDULE

A. Provide a Submittal Schedule within 10 Days of Owner’s Acceptance of the Project Schedule per Section 01 33 00 - Submittals.

PART 2 PRODUCTS

2.01 SCHEDULING SOFTWARE

A. Contractor shall utilize Primavera P6 unless otherwise agreed to by Owner.

B. Contractor shall provide a licensed and royalty pre-paid copy of the mutually agreed upon scheduling software. The selected software must be capable of performing target-to-current schedule comparisons, cost and resource loading functions and have the option of executing calculations in retained logic. Activities must be able to process lead and lag time relationships, start-to-finish or finish-to-finish relationships, and be capable of being hammocked, if required. The software must be registered with Owner and be provided in a format compatible with Owner's systems.

END OF SECTION 01 32 13
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction photography.

B. Construction photography of Work-in-progress.

1.02 GENERAL

A. Contractor shall provide photographs taken from locations coordinated with Owner.

B. Photographer: Experienced in taking construction photography.

C. Equipment: All photos shall be in digital format.

D. Video images may be acceptable for certain operations. Confirm with Owner.

PART 2 PRODUCTS

2.01 PRECONSTRUCTION PHOTOGRAPHS

A. Contractor shall provide electronic files containing photographs of the existing conditions at the site, surroundings, and haul routes per the Pre-Construction Submittal Requirements of Section 01 33 00. Coordinate with Owner the extent of the preconstruction photographic record that is required.

2.02 CONSTRUCTION PHOTOGRAPHS

A. Contractor shall provide electronic files containing photographs of construction progress on a monthly basis.

2.03 PHOTOGRAPHIC SUBMITTALS

A. Photographs shall be submitted each month during the Contract Time, or as otherwise agreed upon by Owner. The number of photographs shall be sufficient to document the site to the satisfaction of the Owner and Contractor.

B. Photographs shall be representative of Project progress, showing all major Work and any critical concealed conditions.

C. The files in each monthly photograph submittal must each be labeled with the Project name, Project number, and submittal date. Additionally, each photograph shall be dated, labeled, and accompanied by a brief description identifying the location and direction the photo was taken. Date stamp using month/date/year format.
3.01 PRECONSTRUCTION PHOTOGRAPHS

A. Coordinate the scope of preconstruction photographic record survey with Owner.

B. Take preconstruction photographs to identify and establish a baseline record of existing conditions.

C. A preconstruction photographic record survey shall include, but not be limited to, all areas that may be impacted or damaged by construction phase activities.

D. The extent or nature of the existing site and adjacent surroundings shall be thoroughly documented.

3.02 CONSTRUCTION PHOTOGRAPHS

A. Contractor shall take construction photographs each month during construction of the Project.

B. Contractor shall document concealed conditions (once exposed) that differ from expectations.

1. It is critical that Contractor photographically document concealed conditions that may benefit Owner’s future maintenance and operations activities. Take photographs (with a reference point) prior to cover or concealment. For example:
   b. Under-slab utility rough-in.
   c. Wall cavity utility routing.
   d. Above-ceiling installation after ceiling support system installed, but prior to cover.

2. The photograph record described above shall be considered minimum and shall not be deemed to limit the quantity or quality of the photographic record.

END OF SECTION 01 32 33
PART 1  GENERAL

1.01  SUMMARY

A. This section includes administrative and procedural requirements for submittals required for performance of the Work, including:

1. Pre-Construction Submittal Requirements;
2. Shop Drawings;
3. Product data;
4. Samples; and
5. Mock-ups.

1.02  SUBMITTAL PROCEDURES

A. Provide submittal schedule as required by Section 01 32 13 – Progress Schedule. The Submittal Schedule shall meet all of the requirements below.

B. Coordination: Review of the submittals by Owner is not for the purpose of determining their accuracy and/or completeness, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of Contractor as required by the Contract Documents.

1. Owner reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are provided.

2. Allow at least 14 Days for review of each submittal by Owner. Complex or interrelated submittals, or the submission of multiple submittals at or near the same time, will require additional time. Provide a "priority list" when submitting multiple submittals at or near the same time. Submittal sequencing should coincide with the submittal schedule (see Section 01 32 13 – Progress Schedule).

C. Submittal Preparation: Place a permanent label or title block on each submittal for identification.

1. Include the following information on the label or title block:
   a. Project name, Project number, and date;
   b. Name and address of Owner;
   c. Name and address of Contractor and submitting Subcontractor, if applicable;
   d. Name and address of supplier and manufacturer, if applicable;
   e. Number and title of appropriate Specification section; and
   f. Drawing number and detail references, as appropriate.
2. Provide adequate space for action stamps to record review.

D. Submittal Transmittal: Package submittals in manageable quantities and transmit to Owner and Architect/Engineer, if applicable, simultaneously. Submittals received from sources other than Contractor will be returned without action. By submitting submittals, Contractor represents to Owner that Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements, and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within each submittal with the requirements of the Work and of the Contract Documents.

1. Address one topic or related set of topics in each transmittal based upon Specification sections (i.e., mechanical items should not be submitted under same transmittal with electrical items).

2. Clearly call out relevant information, deviations, and requests for data, including minor variations from the Contract Documents on both the transmittal and all copies of a submittal.

3. Shop drawings, product data, samples, and mock-ups shall be submitted to Owner’s Designated Representative for review/approval. The minimum number of submittals to be provided are:
   a. Pre-Construction, Shop Drawings, Product Data: Electronic copies.
   b. Samples: As required by the technical Specification section.
   c. Mock-ups: As required by the technical Specification section.
   d. Demonstrations: As required to facilitate installation and inspection.
   e. Reference technical Specifications for additional submittal requirements.

4. Owner may modify the required submittal quantities.

E. Material and Color Submittal: Submit samples of actual colors and/or materials.

F. Number submittals by Specification section number and revision letter.

G. In the event of the need to "revise and resubmit" a submittal, resubmit same in acceptable form/content, clearly identifying deviations from the previous rejected submittal. Contractor shall also keep accurate records of the receipt, review, and delivery of all submittals and shall submit to Owner, as requested, status reports.

H. Provide a final electronic copy of all approved submittals.

1.03 PRE-CONSTRUCTION SUBMITTAL REQUIREMENTS

A. All Pre-Construction Submittals are required before onsite construction activities may commence. Contractor shall submit the following Pre-
Construction Submittals within 14 Days of Notice to Proceed. Submittal review for these items only shall be supplied within 14 Days of receipt by Owner.

1. Indoor Air Quality Management Plan
2. Site Safety and Health Plan (for information only)
3. Quality Control / Quality Assurance Plan
4. Waste Management Plan
5. Progress Schedule
6. Schedule of Values
7. Pre-Construction Photographs
8. Emergency Points of Contact
9. List of Subs and Suppliers
10. SWPP (Storm Water Pollution Prevention Plan)
11. Demolition Plan
12. Traffic Control Plan
13. List of Long Lead Items

1.04 SHOP DRAWINGS

A. Submit Shop Drawings drawn to accurate scale. Do not reproduce Contract Documents or copy standard information for use as Shop Drawings. Standard information prepared without specific references to the Project will not be accepted as a Shop Drawing.

B. Shop Drawings Include: fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:

1. Dimensions;
2. Products and materials;
3. Compliance with specified standards;
4. Coordination requirements;
5. Notation of dimensions established by field measurements;
6. Any deviation from Drawings or Specifications; and
7. Date when review is requested to maintain Progress Schedule.

1.05 PRODUCT DATA

A. 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. Where product data must be specially prepared because standard printed data is not suitable, the submittal must be provided as a Shop Drawing.
B. Requirements: Mark each copy to show applicable options. Include the following information:

1. Manufacturer's printed recommendations;
2. Compliance with recognized trade-association standards;
3. Compliance with recognized testing-agency standards;
4. Application of testing-agency labels and seals;
5. Notation of dimensions verified by field measurement;
6. Notation of coordination requirements;
7. Any deviation from Drawings or Specifications; and
8. Date when review requested to maintain Progress Schedule.

1.06 SAMPLES AND MOCK-UPS

A. Submit samples and mock-ups that are identical to the material or product proposed. Samples include partial sections of components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.

1. Package samples to facilitate review. Include the following:
   a. Generic description of the sample;
   b. Source;
   c. Product name or name of manufacturer;
   d. Compliance with recognized standards;
   e. Availability and delivery time; and
   f. Specification section.

B. Requirements: Submit samples and mock-ups for review of kind, color, pattern, and texture for a comparison of these characteristics before actual installation.

1. Where variation in color, pattern, texture or other characteristics are inherent in the material, submit not less than four units to show limits of variation.

C. Submittals: Where samples are for selection of appearance from a range of standard choices, submit a full set of choices for the material or products.

D. Maintain sets of approved samples and mock-ups at the Project site for quality comparisons throughout the course of construction.

E. Demolish and remove all samples and mock-ups prior to Substantial Completion but not sooner than directed by Owner.

1.07 OWNER'S ACTION

A. Review: Except for submittals for information or a similar purpose, Owner will review each submittal, mark to indicate action taken, and return promptly.
B. Owner approval of submittals does not supersede or alter Contract Document requirements.

END OF SECTION 01 33 00
PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the administrative and procedural requirements for any general alterations to be performed during the Project, including but not limited to products, transition and adjustments, cutting, patching, and repair and cleaning.

1.02 SUBMITTALS

A. Contractor shall submit a written request in advance of cutting or alteration that impacts:

1. Structural integrity of any element of Project.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Efficiency, maintenance, or safety of any operational elements.
5. Work of Owner or a separate contractor.

B. Contractor must include in its written request, when required:

1. Identification of Project.
2. Location and description of affected Work.
3. Necessity for cutting or alteration.
4. Description of proposed Work and products to be used.
5. Alternatives to cutting and patching.
6. Effect on Work of Owner or separate contractor.
7. Written permission of affected separate contractor.
8. Date and time Work will be executed.

1.03 QUALITY ASSURANCE

A. Limits of Work:

1. Contractor shall maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be removed; do not cut such existing conditions beyond indicated limits.
2. Contractor shall maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be removed; do not cut such existing conditions beyond indicated limits.
3. Contractor shall maintain existing nonshell, nonstructural components (walls, flooring, and ceilings) not indicated to be removed; do not cut such existing conditions beyond indicated limits.
B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

C. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Conveying systems.
8. Electrical wiring systems.
9. All low voltage systems.
10. Operating systems of special construction in Division 13.
11. Other operating systems as appropriate.

D. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended that result in increased maintenance or decreased operational life or void of warranty, or could adversely affect safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Firestopping or fire barriers.
3. Membranes and flashings.
4. Exterior curtain-wall construction.
5. Equipment supports.
6. Piping, ductwork, vessels, and equipment.
7. Noise and vibration-control elements and systems.
8. Other miscellaneous systems as appropriate.

E. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exterior conditions or in occupied spaces in a manner that would, in Owner's opinion, reduce the building's aesthetic qualities. Contractor shall remove and replace conditions that have been cut and patched in a visually unsatisfactory manner.

PART 2 PRODUCTS

2.01 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. New Materials: Match existing products and Work when patching and extending Work.
B. Type and Quality of Existing Products: Determine by inspection and testing products where necessary; refer to existing Work as a standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents related to that portion of the Work, as well as other information available to Contractor, take field measurements, and inspect any existing conditions, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing Work, inspect conditions affecting performance of Work.

C. By beginning any cutting or patching, Contractor represents and warrants its acceptance of existing conditions.

D. Contractor shall verify that demolition is complete and areas are ready for installation of new Work.

3.02 PREPARATION

A. Contractor shall cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

B. Contractor shall remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, deteriorated masonry, concrete, and disturbed subgrade material. Replace materials as specified for finished Work.

C. Contractor shall remove debris and abandoned items from area and from concealed spaces.

D. Contractor shall prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.

E. Contractor shall close openings in exterior surfaces to protect existing Work. Contractor shall insulate ductwork and piping to prevent moisture and condensation in exposed areas.

F. Contractor shall provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect Work from damage.

3.03 PERFORMANCE

A. Contractor shall coordinate alterations and renovations to expedite completion of the Work.
B. Remove, cut, and patch Work in a manner to minimize damage. Provide a means of restoring products and finishes to their original or specified condition.

C. Refinish remaining existing surfaces in renovated rooms and spaces, to specified condition for each material, with a neat and clean transition to adjacent finishes.

D. In addition to specified replacement of equipment and fixtures, restore existing plumbing, heating, ventilation, air conditioning, and electrical systems to full original operational condition.

E. Install products as specified in individual sections.

F. Remove samples of installed Work for testing when requested.

G. Provide openings in the Work for penetration of mechanical and electrical Work.

H. Cut rigid materials using the appropriate equipment and tool. Pneumatic tools not allowed without prior approval.
   1. Concrete Walls: Saw-cut walls using accurately located straight lines, unless directed otherwise. Minimize overcuts.
   2. Masonry Walls: Saw-cut along mortar joints, cutting block uniformly in accurately located straight lines, unless otherwise directed. Remove all mortar adhering to edges. Overcuts not allowed.
   3. Wood Framed Walls: Demolish plaster or gypsum wallboard, removing wall framing only as required. Cut wall finish materials in straight uniform lines.
   4. Concrete Floors: Saw-cut floors and remove. Core drill as required.

I. Restore Work with new products in accordance with requirements of Contract Documents.

J. Fit Work to existing pipes, sleeves, ducts, conduit, and other penetrations through surfaces, while maintaining assemblies.

K. At penetrations of fire rated walls, partitions, ceilings, or floors, completely seal voids with firestopping material to full thickness of the penetrated element, while maintaining assemblies.

L. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 35 16
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements pertaining to regulatory requirements.

B. List of regulatory requirements.

1.02 CONTRACTOR RESPONSIBILITY

A. Contractor is solely responsible for compliance with all codes, laws, or regulatory requirements.

B. Inspections performed or not performed by the Skagit County, Labor and Industries, Owner, Owner Designated Representative, or others who are under contract to Owner do not waive or change Contractor’s obligations, nor do such inspections constitute approval or acceptance of portions of the Work.

1.03 CONTRACTOR REQUIREMENTS

A. Contractor shall perform the Work in accordance with the requirements of governing agencies and applicable regulatory requirements, including those included in this Section and elsewhere in the Contract Documents. Contractor must comply with all applicable laws, building codes, regulations, and rules, including, when applicable, the Washington State University campus code.

B. Contractor shall schedule and coordinate inspections and gain approvals required by Skagit County and other governing agencies in a timely manner and as required for Owner occupancy of the Project within the Contract Time.

C. Contractor shall inform Skagit County Building and Fire Departments, Labor and Industries, and other governing agencies of changes in the Work affecting regulatory requirements in a timely manner.

D. Contractor shall promptly forward to Owner all inspection reports, orders, permits, and other directives and correspondence received from Skagit County inspectors or other governing agencies having jurisdiction over the Work.

E. Contractor shall promptly notify Owner when the Contract Documents appear to be in conflict with Regulatory Requirements.

F. Contractor shall, at all times, use its best efforts and exercise its judgment as an experienced contractor to adopt and implement policies and practices designed to avoid work stoppages, slowdowns, disputes, or strikes where reasonably possible and practical under the circumstances, and shall, at all times, maintain Project-wide labor harmony.

1.04 REGULATORY REQUIREMENTS

A. Authority Having Jurisdiction (AHJ) shall be the organization, office, or individual...
responsible for enforcing the requirements of the applicable code(s) or standard(s), and or for approving equipment, materials, installation(s), or procedure(s).

B. Regulatory authorities establish minimum requirement levels. Where provisions of the Contract Documents and regulatory requirements differ or conflict, the more stringent requirement governs.

C. Regulatory requirements added by other sections of the Contract Documents or otherwise applicable are binding upon the Work in accordance with the provisions of this Section. The regulatory-requirements list provided below is intended to assist Contractor in determining the regulatory requirements for the Project, but neither the inclusion nor omission of any item from the list shall be construed to relieve Contractor of obligations that otherwise exist under the law or the Contract.

1.05 LIST OF REGULATORY REQUIREMENTS


C. National Fire Protection Association (NFPA) Codes.


H. State of Washington, WAC Chapters 173, 246, and 296, as applicable.

I. U.S. Environmental Protection Agency 40 CFR, as applicable.

J. U.S. Transportation Department Title 49, Parts Pertaining to Transportation of Hazardous Materials.

K. U.S. Nuclear Regulatory Commission Title 10, Parts Pertaining To Radioactive Materials Management.


M. Washington State Energy Code, WAC 51-11C. Shortened


P. Federal Emergency Management Agency (FEMA) requirements for floodway/floodplain development.

Q. Electrical Work:
   1. NFPA 70, National Electrical Code (NEC), most recent adopted edition.
   2. Underwriters' Laboratories (UL).
   3. National Electrical Manufacturer’s Association (NEMA).

1.06 PERMITS REQUIRED

A. Contractor shall obtain and pay for all required building permits, including any renewals. Contractor shall identify costs for permits on the Schedule of Values for permits obtained.

B. All trade permits (e.g. electrical, pressure vessel, elevator, etc.) must be included in each Subcontractor bid.

C. Owner obtains permits for the following facilities and activities.
   1. U.S. Army Corps of Engineers:
      a. Wetlands (404).
   2. Permits and/or Approvals from the DOE or local environmental authority:
      a. Stormwater from Construction Sites (Notice of Intent).
      b. Wastewater Discharge Facilities.
      c. Well Construction (including Well Abandonment).
      d. Water Rights.
      e. Notice of Construction (Air Pollution Sources).
      f. SEPA.
      g. Floodway/Floodplain development.

1.07 APPRENTICESHIP REQUIREMENTS – NOT USED

END OF SECTION 01 41 00
PART 1 GENERAL

1.01 SUMMARY

A. Conduct portions of the Work requiring special procedures due to hazardous materials and conditions in accordance with regulatory standards and guidance provided in this Section.

1.02 SUBMITTALS

A. Contractor shall deliver a current copy of its site specific Health and Safety Plan to the Owner per the Pre-Construction Submittal Requirements of Section 01 33 00. The submittal must include each Subcontractor’s site specific Health and Safety Plan. Submittal to Owner is for information only, not for review, acceptance, or approval of the Health and Safety Plan, nor for analysis of content or completeness.

1.03 QUALIFICATIONS OF HEALTH AND SAFETY PERSONNEL

A. Contractor shall employ a competent person for each hazardous construction task in accordance with the requirements of WAC 296-155.

B. Contractor shall submit to Owner the names of its employees performing duties as competent persons, as well as the names of Subcontractor employees performing duties as competent persons.

1.04 HAZARDOUS MATERIALS MANAGEMENT

A. Dangerous Waste Management:

1. Contractor agrees and acknowledges that:

   a. Contractor has direct and exclusive control over the Work and operations at the Project site and is responsible for any Contractor generated, created, or disturbed Washington State dangerous waste and its collection, labeling, accumulation, transportation, and disposal. Owner’s EH&S department will provide assistance to Contractor upon request, and will coordinate transportation and disposal of Project-generated Washington State dangerous waste.

   b. Contractor must provide Owner immediate notification of any pre-existing unanticipated Washington State dangerous waste or site contamination.

2. Contractor is responsible for securing its own waste generator identification number, and Contractor shall sign all manifests associated with the Contractor-generated waste.

   a. Contractor shall obtain an EPA/State ID number in accordance with WAC 173-303-360 before conducting activities generating chemical waste designated as Washington State dangerous waste.
b. Contractor shall cancel the EPA/State ID number when:
   1) All activities generating or managing waste have ceased;
   2) All regulated wastes have been removed from the Project site under proper manifests, and all site contamination is remediated; and
   3) All annual dangerous-waste reporting requirements are complete.

c. Contractor may call the Washington State Department of Ecology (DOE) to request a reporting package for early submittal.

d. Contractor shall furnish to Owner’s EH&S Department, Pullman, WA, within 3 Days from submittal or receipt, copies of the following documents:
   1) Form 2 Notification of Dangerous Waste Activities;
   2) All signed Uniform Hazardous Waste Manifests (original copy when shipping wastes and copy returned from the treatment, storage, disposal, or recycling facility), Land Disposal Restriction Notification forms, Certificates of Recycling/Disposal/Destruction, and Exception Reports;
   3) All Annual Reports; and
   4) All correspondence from the DOE.

3. Owner remains responsible for Washington State dangerous waste and site contamination: (1) pre-existing Contractor’s activities at the site, (2) not listed in the Contract Documents, and (3) not disturbed by Contractor through improper construction activities.

4. For waste identified in contract document and for unanticipated Washington State dangerous waste or site contamination discovered during the course of the Work on the site, Contractor shall:
   a. Collect, containerize, and accumulate all Washington State dangerous waste or site contamination in accordance with applicable Federal, State, and local regulations.
   b. Coordinate all transportation and disposal activities through Owner’s EH&S department, who will utilize the Washington State Hazardous Waste Disposal Services contract or equivalent pre-approved contractor. Owner’s disposal contractor shall complete all applicable dangerous waste shipping papers including all Uniform Hazardous Waste Manifests, Land Disposal Restriction Notification forms, profiles and barrel packing lists.

B. Hazardous Materials Spills and Releases:

1. Contractor and Subcontractor(s) shall immediately report all hazardous materials spills at the Project site to Owner. If a hazardous material spill occurs at a Project site in Whitman County, and if any individual may be affected by the spill, Contractor and/or Subcontractor(s) must immediately
report the spill to Whitcom (emergency dispatch). In other counties, Contractor and Subcontractor(s) must report spills to the appropriate emergency response agency in that area.

2. Contractor shall be responsible for spill containment, cleanup, decontamination, post-cleanup monitoring, disposal of any wastes generated from cleanup activities, and generation of any reports required by regulatory agencies and/or regulations including, but not limited to, WAC 173-303 and WAC 173-340.

C. Spill Prevention Control and Countermeasures:

1. Owner’s EH&S department is responsible for Owner’s SPCC Plan. Any of Contractor’s on-site activities involving the handling and/or storage of materials meeting the definition of oil per 40 CFR 112 in containers and/or equipment with a capacity greater than 42 gallons must be included in the Owner’s SPCC Plan. Contractor shall provide Owner’s EH&S department with an inventory of this equipment or containers at least 14 Days prior to the equipment or containers being brought to the Project site.

2. Contractor shall provide and utilize secondary containment for containers and tanks of oil with a capacity greater than 42 gallons. Owner may waive this requirement in its sole discretion upon Contractor’s request after Owner reviews Contractor’s written explanation as to why secondary containment is unnecessary for a particular container or tank.

D. Asbestos:

1. All Contractor employees involved in excavation or demolition shall be asbestos awareness trained. Contractor shall submit to Owner the name of Contractor’s competent trainer, the names of each of Contractor’s trained personnel, and the date of each training. Contractor’s submittal must also state that the training was conducted for asbestos awareness for the Work.

2. All asbestos abatement Work shall be performed by persons trained in Washington State-approved courses and certified by the State of Washington.

3. All asbestos abatement Work performed shall be overseen by a consultant hired by the Owner to ensure the Work meets regulatory standards and Owner requirements.

4. All asbestos cement pipe Work shall be performed by persons trained in an asbestos cement pipe procedures course whose content is reviewed and approved by the Washington State Department of Labor and Industries, per WAC 296-62-0772(3)(ii)(C).

5. If suspected asbestos-containing material is discovered during Contractor’s execution of the Work, and abatement of the material is not a requirement of the Contract, Contractor shall suspend any Work that affects the material and immediately notify Owner. Contractor shall safeguard the area to prevent entry until certified personnel determine
whether the material is non-asbestos containing or the material is abated, at which time the Work in that area may resume.

E. Lead:

1. Owner shall inform Contractor of lead-containing coatings and materials that the Contractor may encounter while performing the Work. These materials or coatings may release lead into the air, soil, or water, or may be a source of contamination due to skin contact. Owner shall provide general data about the percentage of lead content of each suspected lead-containing material or coating and/or provide Contractor with data showing the amount of lead per surface area.

2. Contractor is responsible for protecting its employees from lead exposure, as required by Washington law.

3. Contractor shall manage all paint chips, building components, soil, and/or other material considered by Owner to be dangerous waste according to the Dangerous Waste Management paragraph.

F. Polychlorinated Biphenyls:

1. Owner may survey oil-filled equipment prior to commencement of construction. This equipment includes, but is not limited to, transformers, electrical switches, hydraulic elevators, emergency generators, capacitors and light ballasts. Owner’s survey shall usually determine if the equipment is filled with oil containing polychlorinated biphenyl (PCB). Owner shall remove, or arrange for the removal of, any equipment that contains oil in concentrations qualifying the equipment as dangerous waste per WAC 173-303.

2. If oil-filled equipment is discovered during Contractor’s execution of the Work, Contractor shall suspend any Work that may affect the equipment and immediately notify Owner. Owner shall test the equipment and determine the appropriate management method for the equipment and the oil it contains.

G. Mercury:

1. Owner may survey all equipment suspected of containing mercury prior to commencement of construction. This equipment includes, but is not limited to, switches and thermostats. Owner’s survey shall determine if the equipment contains mercury. Owner shall remove, or arrange for the removal of, any such equipment.

2. If mercury-containing equipment is discovered during Contractor’s execution of the Work, Contractor shall suspend any Work that may affect the equipment and immediately notify Owner. Owner shall test the equipment and determine the appropriate management method for the equipment and the mercury it contains.

H. Hazardous Materials or Equipment:
1. Fixed equipment such as fume hoods, safety cabinets, and vacuum systems, and related ductwork, fans, and appurtenances, may contain or be contaminated with hazardous materials. Owner may test this equipment to determine what, if any, hazards are present. If equipment contains a hazard, or if the equipment itself is a dangerous waste, Owner shall inform Contractor of the nature of the hazard including any information necessary for Contractor to protect its workers. If the equipment is a dangerous waste, Contractor shall dispose of, or make arrangements for the disposal of, the equipment per the above Dangerous Waste Management paragraph.

I. Underground Storage Tanks (USTs):

1. Removal of USTs shall be performed in accordance with DOE regulations. Removal of existing USTs shall be performed by a DOE-certified UST removal company following the submittal of required forms. Copies of forms must be provided to Owner’s EH&S department at the same time they are submitted to DOE.

2. Installation of any UST must be done by DOE-certified UST installers. The installation shall be permitted by DOE following the submittal of completed UST installation forms. Copies of forms must be provided to Owner at the same time they are submitted to DOE.

3. Retrofits and upgrades of existing USTs must be completed by DOE certified companies. Records of the retrofit or upgrade must be submitted to DOE following the retrofit or upgrade. Copies of such records must be provided to Owner at the same time they are submitted to DOE.

4. If a UST is discovered during Contractor’s execution of the Work, Contractor shall suspend any Work that may affect the UST and immediately notify Owner. Owner will determine if UST must be sampled and/or removed. If necessary, Owner shall engage a certified company to remove UST.

J. Department of Homeland Security (DHS) Chemicals of Interest (COI)

1. Contractor and Subcontractors shall report any COI to Owner as required by the DHS. Contractor may contact Owner’s Representative in conjunction with the University’s EH&S Department for the specific means of reporting.

1.05 WATER AND STORMWATER POLLUTION PREVENTION:

A. Water Pollution:

1. Discharge of any pollutants (including sewage and chlorinated water from water line disinfection) into surface or ground waters of the State (including storm drains, ditches and any other water conveyances) is prohibited.
2. Contractor removal of snow, ice, soil, and mud from roadways and sidewalks shall be accomplished without polluting storm drains or surface waters. Mud and soil removal shall be undertaken on a full-time basis, not just once or twice a day. Soil or mud that is dropped onto streets and sidewalks by vehicles at the Project site shall immediately be cleaned by Contractor. Contractor may not use water to clean streets and sidewalks. Under no circumstances may dust mitigation cause soil erosion or pollution of surface waters.

3. If a discharge to surface or ground waters does occur, Contractor shall immediately notify Owner.

B. Stormwater Pollution Prevention Plan (SWPPP):

1. For projects that disturb a soil surface area of one acre or greater:
   a. Contractor shall prepare a written SWPPP that meets DOE regulations and the requirements of Owner’s Municipal Stormwater Permit.
   b. Owner shall apply for a DOE NPDES Construction Stormwater General Permit for stormwater discharge, and then transfer the permit to Contractor. Contractor shall comply with all provisions of the permit.
   c. Contractor shall maintain a copy of the NPDES permit and the SWPPP on-site at all times.
   d. Contractor shall maintain on-site or on call, at all times, a Certified Erosion and Sediment Control Lead (CESCL).
   e. Contractor’s SWPPP shall identify all management practices used to prevent stormwater pollution and the location(s) at which each practice will be utilized on the Project site.
   f. Contractor shall obtain approval from Owner of the SWPPP prior to groundbreaking. Contractor shall construct approved BMP’s and the site inspected and approved, per permit requirements, prior to groundbreaking.
   g. Contractor shall use best management practices (BMPs) and shall inspect BMPs at least once a week. In addition, Contractor shall inspect BMPs immediately following each rainfall event of 0.1 inches or greater.
   h. Contractor shall maintain a written log detailing the results of inspections beginning with the first day of construction. Contractor’s written log shall describe all erosion control activities resulting from inspections. In addition, the following dates and events shall be included in the written log:
      1) The beginning and completion of major grading activities.
      2) Rainfall events of 0.1 inches or greater.
3) When construction activities temporarily or permanently cease on-site, or on a portion of the site.

4) When stabilization measures are initiated for portions of the site.

5) Stormwater sampling results.

i. Contractor shall maintain and/or repair all BMPs as necessary to ensure continued performance of their intended function. Contractor’s maintenance and repair activities shall include, but are not limited to:

1) Removal of sediment from silt fences before it reaches approximately one third the height of the fence, especially if heavy rains are expected; and

2) Cleaning or removal and replacement of drain inlet protection devices at least once every 7 Days, and once daily during storm events or before 6 inches of sediment can accumulate.

j. Contractor shall remove all temporary erosion and sedimentation control measure from the Project site within 30 Days after final site stabilization is achieved, or after the temporary BMPs are no longer necessary. Contractor shall remove any trapped sediment from the Project site. Contractor shall permanently stabilize any areas of soil disturbed by sediment removal.

k. In addition to sediment control, Contractor shall prevent other pollutant discharges from contaminating stormwater, groundwater, or soils.

1) Any maintenance or repair of heavy equipment and vehicles involving oil changes, hydraulic system draining and removal, solvent and degreasing cleaning operations, fuel tank draining and removal, and other activities that may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contractor shall immediately clean any contaminated surfaces following any discharge or spill incident. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle.

2) Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system.

3) Application of agricultural chemicals including fertilizers and pesticides shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers’ recommendations for application rates and procedures shall be followed.

4) Use of lime, flyash, or other soil amendments that could alter the pH of discharge waters is prohibited.
5) Highly turbid or contaminated dewatering water from construction equipment operation shall be handled separately from stormwater. Management options include infiltration, transportation off-site for legal disposal, or use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.

I. Contractor shall provide to Owner all notifications/reports required by permit to DOE.

1) If stormwater sampling results show turbidity greater than or equal to 250 NTU, Contractor shall immediately report to DOE and shall notify Owner of the report.

2) Contractor shall file monthly Discharge Monitoring Reports (DMR’s) with DOE as required. Contractor shall provide copies of all DMR’s to Owner.

2. For projects that disturb a soil surface area of 5,000 square feet or greater, but less than one acre, provisions shall be made to meet applicable local regulations, as necessary.

a. Contractor shall make provisions for inspection and approval by the local authority prior to groundbreaking.

3. For projects that create additional impervious surfaces, provisions shall be made to meet stormwater flow control and treatment requirements, as applicable.

C. Wetlands:

1. Contractor must follow all Federal, State and local regulations including but not limited to WAC 173-201 regarding protection of wetlands.

1.06 AIR POLLUTION

A. Contractor shall comply with all provisions of the Owner’s Air Operating Permit, WAC 173-400 and WAC 173-401 requirements as applicable.

B. Contractor shall control pollutants, such as diesel emissions, chemical emissions, and dust generated by the Project, so that pollutants do not adversely impact the Project site or the surrounding-area air quality.

C. Contractor shall submit to Owner within 30 Days of the Notice to Proceed a list of any stationary air emission-generating equipment included in the Work, such as: fuel-powered electrical generators, internal combustion engines, boilers, paint booths, CFC-containing equipment, or other regulated emission sources. Contractor shall assist Owner in the preparation of necessary permit applications, and Owner shall obtain necessary permits. Contractor shall abide by any conditions or requirements of permits.

D. Per WAC 173-400, Contractor shall mitigate all fugitive emissions (such as dust, vehicle exhausts, and other emissions that do not pass through a stack, chimney,
or vent) generated by the Work. Contractor shall mitigate dust at the Project site throughout the entire duration of the Work. Dust mitigation may include application of specific chemical compounds approved by Owner, or may be accomplished with intermittent watering and sprinkling at such a frequency as will satisfactorily settle dust (excluding paved surfaces). Paved surfaces shall be cleaned mechanically without the discharge of water or chemicals to storm drains and/or surface waters. Under no circumstances shall Contractor permit dust mitigation cause soil erosion or pollution of surface waters.

E. No materials shall be burned without required permits. If permitted burning is done, odors shall be minimized in accordance with the Owner’s Air Operating Permit.

F. CFCs (chlorofluorocarbons) or HCFCs (hydrochlorofluorocarbons) are not permitted as refrigerants in new or renovation projects. New permanently installed refrigeration equipment, such as chillers, temperature controlled chambers, air conditioning equipment, compressors, etc., must contain HFC (hydrofluorocarbon) refrigerants only (i.e., R-134A, R-404A, or R-507). At the completion of the Project, Contractor must provide detailed documentation to Owner about the refrigeration equipment installed, including identifying markings, capacity, and type of refrigerant. Refrigerant must be installed only by persons certified to do so.

G. Indoor Air Quality:

1. Owner shall notify Contractor of the location of fresh air supply intakes for buildings in the immediate area of the Work, and of fresh air supply intakes for buildings that may be affected by emissions from Contractor operations.

2. Contractor shall notify Owner 3 Days prior to commencing Work in which Contractor must operate vehicles or equipment in areas where fresh air supply intakes are located.

3. Contractor shall notify Owner 3 Days prior to commencing Work in which Contractor will be using solvents or other volatile chemicals, or processes which emit fumes, smoke, or strong odors that may affect fresh air supply intakes, or may enter Owner’s buildings through doorways or windows.

4. Contractor shall not allow its activities that emit vapors, fumes, smoke or strong odors to negatively affect fresh air supply intakes.

5. If air releases of hazardous chemicals must occur, Contractor shall submit no later than 30 Days after the Notice to Proceed a chemical release plan detailing how such incidents may adversely affect Owner. Such a plan shall also specify protection to be provided to the employees of Owner and Contractor actions required to minimize chemical overexposure.

6. During welding activity, Contractor shall confine fumes to the Project site, and the fumes must not adversely affect Owner’s employees or students.
1.07 PUBLIC HEALTH

A. Solid Waste Disposal:
   1. Contractor shall legally dispose of or recycle all solid waste at an off-site location. Contractor shall not burn, dump, or bury waste materials, debris, or rubbish on Owner property. Contractor shall clean the Project site at the end of each work shift. Contractor is liable for any and all damage resulting from improper waste handling and disposal (see Section 07 74 19 - Construction Waste Management).

B. Environmental Noise:
   1. Per WAC 173-60, and applicable local requirements, Contractor shall not exceed maximum permissible environmental noise levels for the duration of the Work.

C. General Sanitation:
   1. Per WAC 246-203, Contractor shall supply adequate water for drinking and hand washing purposes. The use of common drinking cups or towels is prohibited. For hand washing purposes, Contractor shall supply hot running water, soap, disposable towels, and a waste receptacle.

D. Drinking Water Protection:
   1. Per WAC 246-290 and 246-291, Contractor shall protect all public water supplies. No portion of a public water system containing potable water shall be put into service nor shall service be resumed until the facility has been effectively disinfected and a satisfactory bacteriological sample has been obtained from a DOE-certified laboratory. Results of sampling shall be sent to Owner. The procedure used for disinfection shall conform to current standards of the American Water Works Association.
   2. A minimum sanitary control area around all wells shall be maintained at all times. The sanitary control area shall extend at least 100 feet from any well. No source of contamination may be constructed, stored, disposed or applied within the sanitary control area.
   3. If wells are being constructed or abandoned, Owner shall procure the appropriate water rights and construction permits per WAC 173-160. Owner shall provide copies of these documents to Contractor. Wells shall be constructed/abandoned properly by a licensed well driller. Contractor shall submit a plan to Owner detailing how all disinfection shall be accomplished.
   4. Backflow Prevention:
      a. Any connection made by Contractor to Owner’s drinking water system, including connection to a fire hydrant, must be made through a backflow prevention assembly approved by a Washington State certified cross connection control specialist.
(CCS) engaged by Owner and inspected and tested by a Washington State certified backflow assembly tester (BAT).

b. Contractor shall label all non-potable water outlets, in a manner acceptable to the Owner, “Non-potable Water / Do Not Drink”.

E. Vector Control:

1. Buildings shall be constructed so as to minimize the attraction and/or harborage of pests and vectors such as birds and rodents. Minimize bird roosting areas by not constructing exposed pipes, beams, or flat ledges on openings, especially underneath covered areas directly accessible to the outside. Openings 1/4-inch or larger shall be sealed. Leave a minimum of a 3-foot swath around the building that is bare. Do not plant trees, shrubs and grass immediately adjacent to building.

2. The presence of standing water shall be minimized or eliminated to prevent mosquito breeding.

F. On-Site Sewage Disposal:

1. Contractor is responsible for fully complying with WAC 246-272. A construction permit application shall be submitted to the appropriate jurisdictional authority for approval. The jurisdictional authority shall issue a construction permit prior to the commencement of construction and shall perform pre-opening inspections. Contractor shall ensure that the appropriate authority inspects and approves the site prior to construction and when the project is substantially complete.

G. Water Recreation Facilities: NOT REQUIRED

H. Food Service Facilities: NOT REQUIRED

1.08 OCCUPATIONAL HAZARD MANAGEMENT

A. Chemical Hazard Communication:

1. If any hazardous chemicals will be used in the Work or present at the Project site, copies of applicable Material Safety Data Sheets (MSDS) shall be made immediately available to Owner prior to use by Contractor and during any use of the hazardous chemicals in the Work.

2. If the use or presence of hazardous chemicals at the Project site may affect the health of individuals outside the Project site, Contractor shall submit a written plan to Owner at least 30 Days prior to such use or presence detailing how Owner can avoid exposure to the products. Contractor shall submit MSDS / SDS to Owner for any hazardous chemical to which persons outside the project site may be exposed. The exposure avoidance plan shall also specify actions that should be taken if inadvertent exposure occurs. Owner shall provide Contractor with a written plan detailing how Contractor employees can avoid exposure to hazardous chemicals used by Owner that may impact the Project site,
and shall specify actions which should be taken if inadvertent exposure occurs. Owner shall submit MSDS / SDS to Contractor for any hazardous chemical to which persons inside the project site may be exposed.

B. Lock-Out/Tag-Out:

1. When Owner and Contractor are to be engaged in coordinated activities requiring the control of hazardous energy, Owner and Contractor shall inform each other of their respective lock-out or tag-out procedures.

C. Confined Space:

1. When Contractor employees are to enter permit-required confined spaces, Owner shall:
   a. Inform Contractor that the Project site contains permit required spaces and that permit-space entry is allowed only through compliance with a confined-space program meeting WAC 296-809.
   b. Inform Contractor of hazards that have been identified.
   c. Coordinate entry operations with Contractor when both Owner and Contractor personnel will be working in or near permit spaces.
   d. Debrief Contractor at the conclusion of the entry operations regarding any hazards confronted or created in permit spaces during entry operations.

END OF SECTION 01 41 19
PART 1 GENERAL

1.01 SUMMARY

A. Contractor shall perform all Work in a skillful and workmanlike manner. Materials and equipment furnished by Contract and any Subcontractor(s) must be of good quality and new unless the Contract Documents require or permit otherwise. Materials shall conform to the manufacturer’s standards in effect at the date of execution of the Contractor and shall be installed in accordance with the manufacturer’s instructions, specifications, and directions. Contractor shall, if requested by Owner, furnish satisfactory evidence regarding the kind and quality of any materials identifying thereon the source, and warranting their quality and compliance with the Contract Documents.

B. Section includes:

1. Contractor’s Quality Control Program;
2. Field samples;
3. Mock-ups;
4. Manufacturer’s instructions;
5. Manufacturer’s field services;
6. Testing laboratory services; and
7. Contractor tests and inspections.

1.02 QUALITY CONTROL PROGRAM SUBMITTALS

A. Contractor shall submit a written Quality Control Program for the Project per the Pre-Construction Submittal Requirements of Section 01 33 00. This submittal shall include but not be limited to the following:

1. An overview of Contractor’s Quality Control Program.
2. Identification and resume of Contractor’s on-site Quality Control Manager (QCM).
3. A description of the activities, record keeping, and correspondence that the QCM will perform and be accountable for throughout the duration of the Project.
4. A description of the quality control meetings to be conducted, sample inspection check lists (i.e., samples of actual inspection check list forms that will be submitted to Owner when scheduling inspections), and Subcontractors’ quality control representatives. All forms that Contractor intends to use in its Quality Control Program shall be part of the submittal.
5. A description of the QCM activities when inspections fail to verify compliance with the Contract Documents.
   a. These activities are to include, as a minimum, follow-up with
applicable Subcontractors, correction and/or completion of Work required for re-inspection, and the re-inspection.

b. Contractor shall submit its weekly Non-Compliance Logs at least 2 Days prior to each Progress Meeting.

6. A description of the QCM activities to provide the required notifications for inspections.

7. A description of record keeping and information turn-over to Owner as a component of the Operating and Maintenance data (i.e. factory representative’s start-up reports and permission to energize, verification of correct voltage and phasing to motors, etc.).

1.03 CONTRACTOR’S QUALITY CONTROL PROGRAM

A. Contractor shall establish and maintain a written Quality Control Program which shall be issued by Contractor to Subcontractors performing Work on the Project and utilized to verify that the execution of the Work is consistent with the requirements of the Contract Documents.

B. The Quality Control Program shall include, but not be limited to the following:

1. Preparatory Phase:
   a. Prior to beginning Work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. Contractor shall:
   b. Review of each paragraph of applicable specifications, reference codes, and standards. Make a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field at the preparatory inspection. Maintain these copies in the field, available for use by Owner’s Designated Representative until final acceptance of the work.
   c. Review the Drawings.
   d. Check to assure that all materials and/or equipment have been tested, submitted, and approved.
   e. Review provisions that have been made to provide required control inspection and testing.
   f. Examine the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
   g. Perform a physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
   h. Review appropriate accident safety procedures.
   i. Discuss procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Owner’s Designated Representative.

k. Schedule, manage and record the minutes of each preparatory meeting.

l. Review all RFIs associated with the Work.

2. Initial Phase:
   a. At the beginning of the Work, Contractor shall:
   b. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
   c. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing. Resolve all differences and deficiencies.
   d. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
   e. Check safety to include compliance with and upgrading of the Safety Plan. Review with each worker. Particular attention should be given to high hazard work.
   f. Prepare and attach to the daily CQC report separate minutes of this phase.
   g. Repeat the initial phase any time acceptable specified quality standards are not being met.

3. Follow Up Phase:
   a. Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the Work. The checks shall be made a matter of record in the QC documentation. Conduct final follow-up checks and correct deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

C. Contractor’s Quality Control Program shall be independent of any inspections and testing performed by Owner or by any independent testing and inspection agencies hired by Owner.

D. Within the Quality Control Program, Contractor shall have available on the jobsite at all times a written report of quality control activities. At a minimum, the report shall note Project site quality control inspections, performance of scheduled tests and follow-up testing, other required inspections, deficiency log, and examinations of workmanship and quality.

E. Test results shall identify applicable Contract (including Specification) requirements, the test or analysis procedures used, and the actual test results. A statement shall be included that the item tested or analyzed conforms or fails to
conform to the Contract Documents. Each report shall be conspicuously stamped on the cover sheet “CONFORMS” or “DOES NOT CONFORM” as the case may be. All test reports shall be signed by a testing laboratory representative authorized to sign certified test reports. Copies of all test reports shall be available on the jobsite at all times.

F. If the Quality Control Program is found to be defective and Contractor does not promptly correct the deficiency, Owner may:

1. Withhold payment until satisfactory corrective action has been taken, or
2. Issue a stop work order until satisfactory corrective action has been taken.

G. Pre-Inspections: Contractor shall pre-inspect Work that requires normal, special, and additional inspections as indicated in the Contract Documents.

1.04 FIELD SAMPLES

A. Field samples are defined as the partial installation of selected materials at the Project site for Owner’s review and acceptance of visual features and workmanship. Generally, accepted field samples are incorporated into the Work.

B. Contractor shall provide field samples as required by the Contract Documents at location acceptable to Owner.

C. Perform Work in accordance with the Contract Documents.

D. Approved samples will serve as an acceptable standard of quality and workmanship.

E. Maintain samples until completion of relevant Work.

F. Upon completion of relevant Work or when directed by Owner, demolish and remove samples from Project site unless sample is accepted as part of completed Work.

1.05 MOCK-UPS

A. Contractor shall provide mock-ups as required by the Contract Documents. Provide additional mock-ups, as required by Owner, until approval is obtained.

B. Do not proceed with subsequent Work until approval of the mock-up is obtained.

C. The approved mock-up shall be the standard of workmanship and materials for the Work that is represented by the mock-up.

D. Maintain mock-up in approved condition, until directed otherwise by Owner.

E. Unless specified otherwise, remove mock-up at completion of the Work or when directed by Owner.
F. Unless specified or approved otherwise, mock-ups shall be completed and approved prior to the pre-installation meeting at which the Work represented by the mock-up will be discussed.

G. Notify Owner a minimum of 7 Days prior to requesting mock-up approval.

1.06 MANUFACTURERS’ INSTRUCTIONS

A. Contractor shall comply with manufacturers’ instructions in full detail, including each step in sequence. Do not omit preparatory steps or installation procedures unless specifically modified or exempted by Contract Documents.

B. Should instructions conflict with Contract Documents, Contractor shall request clarification before proceeding.

1.07 MANUFACTURERS’ FIELD SERVICES

A. When specified, Contractor must require product manufacturer to furnish a qualified representative to observe field conditions and quality of workmanship, and to provide recommendations, certifications, and other specified services.

B. Representative shall submit written report to Owner listing observations and recommendations.

1.08 TESTING LABORATORY SERVICES

A. Owner will arrange for services of an independent Testing Laboratory to inspect and test the Work to verify compliance with Contract Documents.

B. Contractor’s Responsibilities:

1. Cooperate with Testing Laboratory personnel, and furnish access, tools, samples, certifications, test reports, design mixes, equipment, storage, and assistance as requested by the Testing Laboratory.

2. Notify Owner and Testing Laboratory a minimum of 7 Days in advance of all required tests and 48 hours in advance of all required inspections. When tests or inspections cannot be performed, through fault of Contractor, Contractor shall reimburse Owner for costs incurred by Owner.

3. Contractor shall remove and replace Work found to not comply with Contract Documents.

4. If initial tests and inspections indicate deficient work, Contractor shall reimburse Owner for costs of all subsequent tests and inspections related to such deficiency.

5. All damage to Work as a result of normal testing operations shall be repaired by Contractor to match surrounding surfaces.

6. Schedule testing and inspection so that work of testing and inspection
personnel will be as continuous and brief as possible.

7. Contractor shall reimburse Owner for travel and lodging expenses incurred for testing and inspection services performed outside a radius of 100 miles of the Project site.

1.09 CONTRACTOR TESTS AND INSPECTIONS

A. Inspection and testing performed exclusively for Contractor’s convenience shall be the Contractor’s sole responsibility.

B. Earthwork Compaction Testing Requirements:

1. Owner will engage the services of a Testing Laboratory to perform all soil and structural fill compaction testing. Compactions of any fill material shall be equal to or exceed the specified percentage of maximum dry density as defined by ASTM test procedure D1557 (modified proctor). Obtaining such specified compaction performance is the sole responsibility of Contractor.

2. During any of Contractor’s operations, Owner reserves the right to perform compaction tests for its own information only. At Owner’s discretion, copies of such tests may be made available to Contractor. The taking of any such tests by Owner in no way relieves Contractor from testing to assure itself of compliance with the Contract Documents.

C. Approved Structural Steel Fabricators:

1. Contractor shall pay for any required structural steel fabrication special inspections.

D. Cast-in-Place Concrete Strength Testing Requirements:

1. Concrete test cylinders will be made by Owner or Owner’s Testing Laboratory. Contractor shall be responsible for proper care of cast cylinders while on the Project site (with respect to temperature, humidity and protection).

2. Contractor is also responsible for timely transportation to the laboratory in Spokane (or closer) on a schedule that will permit adequate laboratory curing before testing.

3. Contractor shall notify the Owner at least 48 hours before any concrete pour to allow time for observation.

4. Frequency and location of tests are to be determined. As a minimum, four test cylinders will be made for each day’s pour or for every hundred cubic yards, whichever is greater.

5. The results of Owner’s tests will be made available to Contractor.

6. The quality of all concrete is to be the sole responsibility of Contractor. If Contractor feels that additional testing is required to assure continued quality control, the frequency, testing, and payment therefore is
Contractor’s responsibility.

E. All Other Work Inspection and Testing Requirements:

1. Contractor shall, at no additional cost to Owner, provide all inspections and tests required to assure full compliance with the Contract Documents. Unless specifically required, Contractor is not required to submit copies of such test results to Owner. Contractor, however, shall maintain copies of all testing and inspection reports at the Project site for inspection and copying by Owner.

2. The performance of testing or inspection by Owner or Owner’s Testing Laboratory does not relieve Contractor from responsibility for meeting all requirements of the Contract Documents.

END OF SECTION 01 45 00
PART 1  GENERAL

1.01  SUMMARY

A. General: Owner will select and employ an independent testing agency, engineering service, or a special inspector to conduct the tests and inspections to be provided by Owner. Inspections that are normally associated with obtaining State approval (e.g., electrical work as specified in Division 26, etc.) shall be provided and paid for by Contractor. Contractor shall comply with all applicable building codes and provide all testing services required by the Contract Documents unless specifically identified as Owner’s responsibility.

B. Owner’s testing agency shall prepare test reports, logs and certificates applicable to the Work for which Owner will provide testing and shall deliver the specified number of copies to the designated parties. If any inspection or testing reveals failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for Owner’s services and expenses, shall be at Contractor’s expense.

1.02  DESCRIPTION

A. Definition: For the purpose of this Section, all references made herein to testing laboratory, testing agency, or special inspector shall refer to as the tests or inspections conducted by a special inspector provided by Owner.

1.03  QUALITY ASSURANCE

A. Qualifications: Contractor’s inspection personnel must be approved by Owner and possess certain qualifications as stated in this Section. The testing agency shall comply with all requirements of ASTM E329.

1. The inspector for waterproofing and roofing shall have specialized technical knowledge and experience specific to waterproofing and roofing.

2. The testing agency for concrete testing and inspection services should be an agency other than the agency employed by Contractor for the purpose of establishing concrete mix designs, etc.

3. Geotechnical inspection will be performed by a licensed geotechnical consulting firm.

1.04  DUTIES OF OWNER’S TESTING AGENCY

A. General: Testing agencies shall conduct testing and inspection services, interpret them, evaluate the results for compliance with the Contract Documents, and report the findings to the Owner, Contractor, and local building authority, as applicable. Testing and inspection services shall be performed in accordance with applicable ASTM standard methods or other specified procedures.
B. Testing: Materials to be tested are those so specified and others as Owner or authorities having jurisdiction over the Project may direct.

C. Inspection: Inspections, continuous and special, shall be performed by the inspectors as required by the Contract Documents and authorities having jurisdiction.

D. Rejected Work: Inspectors shall have the right to recommend rejection of materials and workmanship that is defective. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the Project site without charge to Owner. If Contractor does not correct rejected work within a reasonable time, Owner may elect to correct the work and charge the expense to Contractor.

E. Inspectors are not authorized to do the following:
   1. Release, revoke, waive, alter, or enlarge on requirements of the Contract Documents;
   2. Approve or accept any portion of the Work, except as specified for soil conditions (i.e. bearing capacities, etc.);
   3. Perform any duties of Contractor; or
   4. Stop Work.

F. Should the Owner elect at any time before Final Acceptance to make an examination of Work already completed by removing or tearing out the same, Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such Work is found to be defective in any respect, Contractor shall be responsible for the cost of such examinations and of satisfactory reconstruction. If such Work is found to meet the requirements of the Contract, however, Owner shall be responsible for the cost of such examinations and of satisfactory reconstruction.

1.05 PAYMENTS

A. Owner shall pay for the cost of initial testing and inspection, except as otherwise specified in the Contract Documents. Initial tests and inspections are defined as the first tests and inspections as hereinafter specified.

B. In the event any test or inspection reveals Work not in compliance with the Contract Documents, Contractor shall pay for or be backcharged for all costs of re-testing and/or re-inspection.

C. Additional tests and inspections not herein specified but requested by Owner shall be paid for by Owner, unless the results of such tests or inspections reveal Work not in compliance with the Contract Documents, in which case Contractor shall pay for or be backcharged for all costs of testing, re-testing, re-inspection, and any related Owner costs.
D. Costs for additional tests or inspections required because of any change in materials or change in the source of supply from that specified shall be paid by or backcharged to Contractor.

E. Contractor is responsible for all work required to correct any deficiencies.

F. Contractor is responsible for the cost of any testing required for the convenience of Contractor in the scheduling and performance of the Work.

G. Contractor is responsible for the cost to verify testing done without prior notice, with improper supervision, or contrary to construction practice, and for testing of materials for which mill reports are required but not furnished.

H. Contractor is responsible for the cost of any testing that is required to be performed by Contractor by the Contract Documents.

1.06 TESTS AND INSPECTION REPORTS

A. Copies of Test and Inspection Reports: Copies of test and inspection reports will be distributed at weekly intervals. Such reports shall include all tests performed, regardless of whether such tests indicate that material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations shall also be reported. Test and inspection reports shall be distributed electronically as requested by Owner.

B. Test and inspection reports shall be distributed as follows:
   1. Architect/Engineer;
   2. Structural Engineer;
   3. Civil Engineer;
   4. Owner; and
   5. Contractor.

1.07 CONTRACTOR’S RESPONSIBILITIES

A. Coordination: Contractor shall initiate and coordinate all required tests and inspections, including conforming with requirements of applicable public agencies and authorities. Inspection of the Work does not relieve Contractor of any obligation under the Contract. The Owner’s Designated Representative shall have authority to reject Work that is not in compliance with the Contract Documents.

B. Access: Inspectors shall at all times have free access to the Work, wherever the Work is in preparation. Contractor shall at all times provide and maintain proper facilities and safe access for such inspection. Contractor shall also cooperate with testing personnel and furnish access, tools, samples, certifications, test reports, design mixes, equipment, storage, and requested assistance.
C. Storage Facilities: Contractor shall furnish adequate storage facilities for the sole use of the testing laboratory for safe storage of specimens that must remain on the site.

D. Data: Furnish records, drawings, certificates and similar data, including Shop Drawings and Change Orders, as may be required by the testing and inspection personnel to confirm compliance with the Contract Documents.

E. Notice: Contractor shall furnish notice to Owner and inspector at least 48 hours in advance of all required tests and inspections, unless otherwise specified.

F. Defective Work: Contractor shall remove and replace any Work found defective by Owner or not complying with the Contract Documents at no additional cost or Contract Time. Where testing personnel take cores or cut-outs to verify compliance, repair prior to acceptance. Where defective Work requires redesign, any redesign costs shall be paid for by Contractor.

G. Cancellations: Contractor shall give sufficient advance notice to the inspector to allow in the event of any cancellation or rescheduling of a previously scheduled test or inspection. Any charges due to insufficient advance notice of cancellations or delay shall be paid by or backcharged to Contractor.

1.08 TEST FAILURES

A. Where a sample fails to pass a required test, Owner may permit re-testing of the sampled material. In such cases, two samples shall be tested and the material shall be rejected if either of the two subsequent samples fail.

1.09 REPORTING TEST FAILURES

A. Immediately upon inspector’s determination of a test failure, inspector shall notify Owner. On the same day, inspector shall send written test results to those named on the distribution list above.

1.10 REMOVAL OF MATERIALS

A. Unless otherwise directed, materials not conforming to the requirements of the Contract Documents shall be promptly removed from the Project site and properly disposed of without additional expense to Owner.

END OF SECTION 01 45 23
PART 1 GENERAL

1.01 SUMMARY

A. Contractor shall be evaluated on performance throughout the course of the contract to provide past performance documentation for future projects.

B. Section includes:

   1. Program Objectives;
   2. Performance Categories and Assessment;
   3. Evaluation Reports;

1.02 PROGRAM OBJECTIVES

A. The Contract Performance Evaluation Program is intended to improve contractor selection given the following primary objectives:

   1. Assist the Owner in evaluating the contractor’s qualifications and proven ability to successfully perform future contracts when past performance has been previously documented;
   2. Provide the University objective data relating to Contractor responsibility;
   3. Provide contractors with a means of enhancing their qualifications and reputation by receiving recognition for exceptional performance;
   4. Encourage better working relationships between the University and the Contractor and to provide feedback to the contractor during and after the contract period;

1.03 PERFORMANCE CATEGORIES AND ASSESSMENT

A. Contractor shall be evaluated based upon the following categories:

   1. Schedule and Time Management;
   2. Quality Management;
   3. Communication Effectiveness;
   4. Management Approach;
   5. Code and Compliance; and

B. Each of the above categories will be assessed by multiple key project stakeholders and provided one of the following performance levels based upon objective and cumulative data:
1. Outstanding (5): Contractor has exceeded the majority of all of the significant contract criteria and has met or exceeded the Schedule, Quality, Communications, Management, Code Compliance and Cost requirements of the contract. The contractor was extremely or completely knowledgeable of the contract requirements and applicable laws and regulations. A very consistent high level of cooperation, project management, and job site control appreciably contributed to an unusually good result.

2. Very Good (4): Contractor has exceeded many of the significant contract criteria and has met or exceeded some of the Schedule, Quality, Communications, Management, Code Compliance, and Cost requirements of the contract. The contractor was knowledgeable of the contract requirements and applicable laws and regulations. Was generally cooperative and performed their work with minimal prompting. Their performance results were very good.

3. Satisfactory (3): Contractor has satisfactorily met the overall contract criteria and has met the overall Schedule, Quality, Communications, Code Compliance and Cost requirement of the contract. The contractor occasionally had to be prompted or reminded of the contract requirements, but overall the project was acceptable, producing an acceptable result.

4. Marginal (2): Contractor may have met many, but not all, of the contract criteria and failed to meet one or more of the Schedule, Quality, Communications, Code Compliance or Cost performance requirements of the contract. Even though the project may have been accepted, the contractor’s performance, as evaluated, was marginal overall. The contractor frequently had to be prompted or reminded of the contract requirements; overall the project was less than satisfactory.

5. Unsatisfactory (1): Contractor failed to meet many or most of the contract criteria and failed to meet the overall Schedule, Quality, Communications, Code Compliance and Cost performance requirements of the contract. While the project may have been accepted by the owner, the effort expended in prompting the contractor to perform was excessive. The contractor’s poor or uncooperative performance created serious unnecessary and avoidable difficulties in achieving contract completion.

1.04 EVALUATION REPORTS

A. At the midpoint of project completion, Owner shall provide contractor with a draft Contract Evaluation Report based upon the current performance during the contract. This shall provide the Contractor an opportunity improve performance levels during the contract, and provide an opportunity for Contractor-Owner communication and working relationship.

B. A final Contract Performance Evaluation Report will be completed upon contract completion and shall become the official report of record.
1. A Summary Contract Performance Evaluation will be provided to the Contractor within 30 calendar days after Final Completion.

2. Final Contract Performance Evaluation Reports will remain on record for a minimum of 5 years from date issued.

C. Upon receipt of the Summary Contract Performance Evaluation, Contractor shall review the report and may request a debrief conference within 21 calendar days of receipt.

D. If after the debrief, Contractor would like to dispute the evaluation findings the Contractor shall submit in writing, the specific reasons for disagreement and include the basis for their appeal within 14 calendar days following the debrief.

1. Upon receipt of appeal, Owner shall convene a review with the Assistant Vice President, Facilities Services, Capital to consider the objectivity, accuracy, completeness and fairness of the Contract Performance Evaluation.

2. The Contractor shall be notified and issued a final determination within 30 calendar days of receipt of the appeal.

END OF SECTION 01 45 34
PART 1  GENERAL

1.01  TEMPORARY UTILITIES

A. Owner may furnish to Contractor temporary Owner-owned utilities when available and upon Owner written approval. Owner reserves the right to restrict the use of its utilities if, in its opinion, Contractor fails to adequately conserve utilities or to use utilities appropriately. When using Owner-owned utilities, Contractor is to make metered connections to the nearest available service and disconnect same when no longer needed.

B. If Owner-owned utilities are not available at the Project site, or if Owner restricts use of Owner-owned utilities, Contractor shall obtain required services from commercial sources or public utilities, and Contractor is responsible to pay for all utility costs.

C. Contractor shall field verify the availability of utility services provided by Owner and coordinate the Work accordingly.

D. In remodeling projects where portions of the building are to remain in service, Contractor shall be responsible for coordinating the Work to maintain utility services to the occupied portions of the building.

1.02  TEMPORARY ELECTRICAL SERVICE

A. Contractor shall provide all services required for construction operations and may connect to existing services when available upon Owner approval.

B. Contractor shall provide lighting for construction operations.

C. Contractor may use existing lighting when available and adequate.

D. Contractor shall maintain site lighting throughout the duration of the Work.

1.03  HEAT AND VENTILATION

A. Contractor shall provide heat and ventilation as required to maintain specified conditions for construction operations and to protect materials and finishes from damage due to temperature or humidity.

B. After a building is substantially enclosed, the permanent heating system or a temporary hook-up of equipment from the permanent system may be used for temporary heat provided that the equipment is properly installed by the responsible electrical and mechanical Subcontractors and available for supplying temporary heat. Owner shall be the sole judge of the adequacy of the building enclosure for temporary heating or cooling purposes.

C. Contractor shall arrange with the electrical and mechanical Subcontractors installing said systems and equipment for the use, operation, and maintenance of
the systems. Contractor shall pay for all connections and attendants for temporary heating, including necessary accessories such as temporary (construction) air filters to protect the air distribution systems from contamination.

D. Contractor shall provide a dust free air distribution system and correct all damage to this system caused by the Work.

E. In existing facilities, Contractor shall coordinate use of the existing systems with Owner. Contractor shall extend and supplement with temporary units as required to maintain specified conditions for construction operations.

F. Use of electric resistance type heating systems for temporary heat is prohibited.

G. The warranty period for any permanent equipment used during construction will not commence until Contractor achieves Substantial Completion.

1.04 TEMPORARY WATER SERVICE

A. Unless available from an Owner-owned utility, Contractor shall provide service required for construction operations. At all times, Contractor shall utilize backflow/cross-connection devices, certified by Owner, to safeguard water supply.

B. For Work in existing facilities, Contractor shall connect to existing services when approved by Owner and extend branch piping with outlets so that water is available for use by all persons associated with the Work.

C. Provide drinking water from a safe source for all those associated with the Work.

1.05 SANITARY FACILITIES

A. Contractor shall provide temporary restroom facilities. Facilities shall not directly or indirectly drain or discharge onto Owner property or any waters of the State. Place where directed at the time Work begins; maintain in sanitary condition. Remove upon completion of the Work and disinfect the premises.

B. Use of permanent and/or existing Owner’s facilities is not allowed.

1.06 BARRIERS

A. Contractor shall provide barriers as required to prevent public entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. When temporary fencing is indicated by the Drawings, or if fencing is provided at Contractor’s option, enclosures shall be constructed of 6 feet high commercial grade chain link with vehicular and personnel gates, as required.

1.07 ENCLOSURES
A. Contractor shall provide temporary weather-tight closures of openings to provide acceptable working conditions, protect materials, facilitate temporary heating, and prevent entry of unauthorized persons. Provide doors with self-closing hardware and locks.

B. Contractor shall provide temporary roofing when so indicated by the Drawings or when made necessary by the Project requirements.

C. Contractor shall provide temporary dust-proof partitions when required to confine dust and moisture to the immediate Work area.

D. Contractor shall provide temporary noise-proof partitions when required to confine noise to the immediate Work area.

1.08 PROTECTION OF EXISTING FACILITIES

A. Utility Tunnel Protection: Contractor shall provide adequate planking across any tunnels to distribute loads and prevent damage. If necessary, Contractor shall provide temporary shoring inside tunnel areas.

B. Low Overhead Clearance: Contractor shall be fully responsible for addressing all vehicular limitations caused by low overhead restrictions throughout campus. Route all traffic to avoid damage to overhead structures. Review proposed routing with Owner prior to commencement of construction.

C. Tree and Plant Protection: Contractor shall protect trees and other plants not scheduled for removal; maintain protection until Project completion.

1. In the event that a tree or plant is damaged as a result of the Work that, in the opinion of Owner, requires replacement, Contractor shall be responsible for such replacement.

2. If at any time Contractor judges that the protection of plant materials designated to be saved is incompatible with Work required, or if operations necessarily threaten the health of any plant material, Contractor shall immediately notify Owner and cease Work affecting the area until a written agreement is reached concerning acceptable procedure.

1.09 SECURITY

A. Contractor shall provide security to protect the Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, and theft. Coordinate with Owner's security program.

B. During construction, all openings to Owner's utility tunnel system must be protected against unauthorized entry. Contractor shall provide closures, approved by Owner, including locked doors or hatches at any openings created by the Work.
1.10 PROTECTION OF INSTALLED WORK
   A. Contractor shall provide temporary protection for installed products. Control traffic in immediate area to minimize damage.
   B. Contractor shall provide protective coverings for walls, projections elevator cabs, jambs, sills, and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects, and storage.
   C. Contractor shall prohibit traffic and storage on waterproofed and roofed surfaces and on lawns and landscaped areas.

1.11 CLEANING DURING CONSTRUCTION
   A. Contractor shall clean the site each day during construction and shall prevent the accumulation of waste materials and rubbish.
   B. Contractor shall clean interior areas prior to the start of finish Work and maintain areas free of dust and other contaminants during finishing operations.

1.12 OFF-SITE CLEAN UP
   A. Contractor shall continuously keep sidewalks, lawns, parking areas, and streets clear of construction materials, debris, gravel, rock, and dirt related to the Project.

1.13 LIFTING DEVICES AND HOISTING FACILITIES
   A. Contractor shall provide cranes, hoists, towers, and other lifting devices necessary for the proper and efficient movement of materials.

1.14 MECHANICAL AND ELECTRICAL SYSTEM SHUT-DOWNS
   A. Any shut-down of mechanical or electrical systems affecting Owner’s operations shall be scheduled by Contractor during off-hours. Contractor shall submit a written shut-down request providing at least 14 Days advance notice. Any shut-down must be coordinated with and approved by Owner.

1.15 CONSTRUCTION PARKING
   A. Contractor’s employees may park only in accordance with campus traffic and parking regulations and pay all required fees.
   B. When working in Pullman’s central campus, Contractor’s vehicular use will be limited to the following:
      1. Delivery of materials to and from Project site;
      2. Single vehicle for use by Project supervisor of each major Contractor (four total vehicles maximum); and
3. Workers' vehicles shall not be allowed to park in the central mall.

1.16 NOISE CONTROL

A. Any construction related noise that interferes or is likely to interfere with normal use of adjacent space(s) shall be scheduled and approved by Owner.

B. Contractor shall restrict any construction related noise to the hours approved by Owner and in accordance with the state and local noise ordinance.

C. Owner may approve Contractor working extended hours. Request any extended hours of operation with Owner.

1.17 TRAFFIC OBSTRUCTIONS

A. Contractor shall submit a written traffic control plan for all traffic obstructions, either pedestrian or vehicular, for approval by Owner, per the Pre-Construction Submittal Requirements of Section 01 33 00.

B. In some cases, it may be necessary to develop special routes for large or unwieldy deliveries that could interfere with pedestrian movement, especially at peak times.

C. Contractor shall avoid deliveries or equipment operations that block street traffic during peak times.

D. Pedestrian Obstructions: Any equipment on sidewalks or other pedestrian ways shall be barricaded. Barricades shall include a horizontal member at a maximum of two feet above the walking surface.

1.18 REMOVAL OF TEMPORARY FACILITIES

A. Contractor shall remove temporary materials, equipment, services, and construction facilities prior to Substantial Completion inspection.

B. Contractor shall clean and repair damage caused by installation or use of temporary facilities.

C. Contractor shall restore existing facilities used during construction to specified or original condition.

END OF SECTION 01 50 00
PART 1  GENERAL

1.01 PRODUCTS

A. Products include material, equipment, and systems.

B. Comply with Specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within a specification section shall be the same, and shall be interchangeable.

D. All materials shall be new unless specifically noted otherwise.

1.02 TRANSPORTATION AND HANDLING

A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer’s unopened containers or packaging, dry.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.03 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer’s instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer’s instructions.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.04 VARIATION FROM SPECIFIED PRODUCTS

A. Subsequent to Bid Opening/Proposal - Approved Equivalents:

1. Requests for approved equivalents will only be considered when approved equivalent statements, used in reference to product
specifications, are specifically provided for within individual Specification sections.

2. The terms "or an approved equivalent", "approved equivalent", or similar statements, when used herein in connection with manufacturers' products, shall be understood to mean products that are equally effective and suitable for their intended use; based on the judgment of the Owner, whose decision shall be final.

3. Written requests for consideration by the Owner of approved equivalents may be submitted throughout the Project.

4. Time extensions and additional costs resulting from use of approved equivalent products will not be considered.

B. No Substitutions:

1. The terms "No Substitutions", "Alternative Products not Acceptable", or similar statements used in reference to product specifications, shall mean that only the specified product will meet the needs of the University and that no other products will be considered at any time before or during the Project.

C. Requirements and Procedures for Product Variations:

1. The Contract is based on the standards of quality established in the Contract Documents.

2. Substitution or approved equivalent revisions shall be made only with the prior written acceptance of the Owner.

3. All requests for substitutions or approved equivalents must be on the proposer's letterhead and shall be accompanied by complete specifications, samples, records of performance, certified copies of tests by impartial and recognized laboratories, and such other information as the Owner may request to prove the merit of the proposed revisions.

4. The Contractor assumes the responsibility for capacity, dimensions, clearance, etc., of the named manufacturer's particular item to assure that the revision meets the requirements.

5. The Contractor shall assume the cost of any redesign, in the form of changes to the Drawings, or for the Work of any other trades, or any other costs required to properly incorporate any revision associated with substitutions or use of approved equivalent products.

6. Final decisions as to the quality and suitability of proposed revisions will rest solely with the Owner and will be based on proof submitted.

7. When the Owner approves a substitution or approved equivalent proposed by the Contractor, it is with the understanding that the Contractor certifies that the article or material is equivalent to or better than that specified.

END OF SECTION 01 60 00
PART 1 GENERAL

1.01 PURPOSE

A. Provide for an orderly, timely, and efficient completion of the Work for Owner.

1.02 SUBSTANTIAL COMPLETION

A. Requirements for Substantial Completion: Contractor shall comply with all requirements for Substantial Completion identified in the General Conditions and other Contract Documents. Prior to Substantial Completion, Contractor must have constructed the Work in substantial accordance with the Contract Documents, and:

1. Certificate of Occupancy received from the AHJ.
2. All elements of the Work must be operational and in good working order and condition, except for incidental punchlist Work;
3. The fire and life safety systems, if any, must be tested and accepted;
4. Any elevators must be operational, functioning, and in good working order and condition, and be fully approved for use;
5. All mechanical, electrical, plumbing, telecommunications, security, and access control systems must operate and function in good working order and condition, including commissioning;
6. The finish portion of the Work must be complete including but not limited to paint, trim, doors, partitions, cabinetry, floor coverings, ceilings, wall finish, and other finish surfaces, except for incidental punchlist Work;
7. All roadway improvements, paving, sidewalks, parking areas, other street improvements, lighting, landscaping and irrigation must be complete;
8. Utilities must be complete, connected, and operating normally;
9. Contractor must have removed all construction facilities, temporary controls, and construction debris;
10. Contractor must have completed training Owner's personnel on all operating instructions and submitted training DVDs; and
11. Final cleaning.

B. Prior to Substantial Completion Contractor shall request in writing that Owner grant Substantial Completion. Accompanying the request Contractor shall submit the following:

1. A list of all items remaining to be completed or corrected;
2. Signed originals from authorities having jurisdiction of all certificates of compliance and final approval, as applicable;
3. All system software files required by the Contract Documents, including
but not limited to lighting and environmental controls;

4. Revised Draft Operation & Maintenance manuals; and

5. Draft Project Record.

C. Upon satisfactory completion of the requirements for Substantial Completion, Owner shall prepare and forward to Contractor a letter of Substantial Completion. The letter will identify the date of Substantial Completion and include a punch list identifying all remaining incomplete Work. Contract warranties shall begin as of the date of Substantial Completion.

1.03 FINAL COMPLETION

A. Requirements for Final Completion: Upon receipt of Contractor’s written Notice that Contractor has inspected and completed punch list items and that the Work is ready for final inspection and acceptance, Owner will promptly make such inspection accompanied by Contractor. If Owner determines that some or all of the punch list items are not complete, Contractor shall be responsible to Owner for all costs, including re-inspection fees, for any subsequent inspection to determine completion of the punch list. When Owner finds all punch list items complete and the Work and Contract fully performed, Owner shall establish the date of Final Completion. Owner is not required to establish Final Completion until the following are complete:

1. Complete all requirements listed in the Contract Documents for Substantial Completion of the Work;

2. Complete all remaining punch list items and remaining Work, and obtain approval by Owner that all Work is complete;

3. Obtain permanent occupancy permits (if only a temporary occupancy permit was issued at Substantial Completion);

4. Submit Project Record, any final property survey, and final Operation and Maintenance manuals (if not previously submitted) required by the Contract Documents;

5. Deliver any required tools, spare parts, extra stock of material and similar physical items to Owner as required by the Contract Documents;

6. Complete cleaning after completion of punch list;

7. Submit executed warranties;

8. Complete any required sustainability documentation for which Contractor is responsible;

9. Submit a final comprehensive list of all Subcontractors of all tiers and suppliers for the Project; and

10. Submit certification that materials used in the Work are "asbestos-free" and that all requirements of governing jurisdictions related to the Project have been addressed.
11. Final Project Record.

B. Upon satisfactory completion of the requirements for Final Completion, Contractor shall submit a final Application for Payment.

1.04 FINAL ACCEPTANCE

A. Requirements for Final Acceptance: Final Acceptance shall be established by Owner in writing. Owner shall not be obligated to accept the Project as complete before Final Completion has occurred and Contractor has submitted the following:

1. An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which Owner or Owner’s property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, except for any claims that are specifically identified on the affidavit (Affidavit of Payment of Debts and Claims, AIA form G706 or equivalent).

2. A certificate or written statement evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 Days' prior written Notice has been given to Owner.

3. Receipt of consent of surety, if any, to final payment (AIA form G707 or equivalent).

4. If required by Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by. If a Subcontractor refuses to furnish a release or waiver required by Owner, Contractor may furnish a bond satisfactory to Owner to indemnify Owner against such lien. If such lien remains unsatisfied after payments are made, Contractor shall refund to Owner all money that Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

5. Provide copy to Owner of all “Affidavits of Wages Paid”. Pursuant to RCW 39.12.040, an "Affidavit of Wages Paid" from Contractor and from each Subcontractor certified by the Industrial Statistician of the Washington State Department of Labor and Industries, with the fees paid by Contractor or Subcontractor.

B. Contingent upon completion of all Affidavits of Wages Paid, the “Notice of Completion of Public Works Contract” form may be completed by Owner.

1.05 RETAINAGE

A. Retainage must be held at least 45 Days following Final Acceptance. If there are either unpaid taxes or fees, or unsatisfied claims of lien against the retained percentage, disbursement of retainage funds will be made in accordance with Washington law.
B. The retainage will be held and applied by Owner as a trust fund in the manner required by RCW 60.28. Release of the retainage will be processed in the ordinary course of business following Final Acceptance of the Work by Owner, provided no notice of lien has been given as provided in RCW 60.28, no claims have been brought to the attention of Owner, Owner has no claims under the Contract, and the requirements below have been met.

C. Owner shall not release retainage until the following requirements have been satisfied.

1. “Certificate of Payment of State Excise Taxes by Public Works Contractor”: Following receipt of Owner’s notice of completion and after determining that all taxes, increase and penalties due from Contractor have been paid, the Department of Revenue will issue this certificate to Owner.

2. “Certificate of Payment of Contributions, Penalties and Interest on Public work Contract”: Upon receiving a copy of Owner’s notice of completion and after determining that Contractor is in compliance with the provisions of the Employment Security Act, the Employment Security Department will issue this certificate to Owner.

3. “Certificate of Release”: Upon receipt of Contractor’s request for release and verification from its records that required premiums have been paid by Contractor and each Subcontractor, the Department of Labor and Industries will issue a statement to that effect.

END OF SECTION 01 70 00
PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for field engineering services, including but not limited to the following:

1. Land survey Work; and
2. Establishment of coordinated reference points for general building layout and location.

1.02 SUBMITTALS

A. Project Record: Contractor shall submit a record of Work performed and record survey data as required by the Contract Documents.

1.03 QUALITY ASSURANCE

A. Surveyor: Contractor shall engage a registered Professional Land Surveyor registered in the State of Washington to perform the required land-surveying services.

B. Owner may furnish surveys describing physical characteristics, legal limitations, utility locations, and a legal description for the Project site. Contractor may rely on the information furnished by Owner but must exercise proper precautions to ensure the safe performance of the Work. Contractor shall assume that the locations of any underground or hidden utilities, underground tanks, plumbing, or electrical runs indicated in the surveys or Contract Documents are shown in approximate locations, but Contractor is responsible for verifying the location of all utilities impacted by the Work. Additionally, Owner may make available to Contractor the results of investigations of hidden or subsurface conditions for the convenience of Contractor. While Contractor may rely upon such investigation results, there is no guarantee, express or implied, that the conditions indicated are representative of those existing throughout the Project site, or that unforeseen developments may not occur. Contractor is solely responsible for interpreting the information and extrapolating beyond the location, including each individual boring, test pit, or other locations.

1.04 EXAMINATION

A. Identification: Contractor shall verify the location of benchmarks and control points provided by Owner.

B. Contractor shall verify layout information on Drawings in relation to the property survey and existing benchmarks before proceeding to layout the Work.
Contractor shall also locate and protect existing benchmarks and control points and preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval of Owner. Promptly report lost or destroyed reference points and requests to relocate reference points because of changes in grades or locations.

2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

C. Contractor shall establish and maintain a minimum of two permanent benchmarks at the Project site.

1. Record benchmark locations, with horizontal and vertical data, on Project Record.

D. Existing utilities and equipment: The existence and location of underground and other utilities are not guaranteed. Before beginning the Work, Contractor shall investigate and verify the existence and location of underground and other utilities (including irrigation and snow melt systems).

1. Prior to construction, verify the locations and invert elevation at points of connection sanitary sewer, storm sewer, and water service piping.

1.05 PERFORMANCE

A. Contractor shall work from lines and levels established by the property survey; establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project; and calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

1. Advise entities engaged in Work activities of marked lines and levels provided for their use.

2. As construction proceeds, check every major element for line, level, and plumb.

B. Surveyor’s Log: Contractor shall maintain a surveyor’s log of control points and other survey Work. Make this log available to Owner for reference.

1. Record deviations from required lines and levels and advise Owner when deviations that exceed indicated or recognized tolerances are detected. On Project Record, record deviations that are accepted and not corrected.

2. Following completion of foundation walls, major site improvements, and other Work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site Work.
C. Site Improvements: Contractor shall locate and lay out site improvements, including pavement, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Existing Utilities: Contractor shall furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances affected by construction. Contractor shall coordinate with local authorities having jurisdiction.

E. Contractor shall record accurately on the Project Record the principal metes, bounds, lines, and levels of the Project.

END OF SECTION 01 71 23
PART 1 GENERAL

1.01 SUMMARY

A. This Section describes the waste management and recycle management criteria for debris and solid waste generated as part of the Work.

B. Contractor shall be responsible for sorting, segregating, and placing designated waste materials into containers provided by Owner. Contractor shall be responsible for segregating and disposing all unacceptable and dangerous wastes as defined below.

C. Waste that is disposed of by Contractor shall be in accordance with all applicable local, state, and federal regulations, including WAC 173-350, Solid Waste Handling Standards, and WAC 173-303, Dangerous Waste Regulations.

1.02 DEFINITIONS


B. Dangerous Waste: Solid waste designated in WAC 173-303 and/or 40 CFR. As used in this Section, the words “dangerous waste” will refer to the full universe of wastes regulated by WAC 173-303 and 40 CFR.

C. Demolition Waste: Largely inert waste, resulting from the selective demolition of buildings, roads and other man-made structures such as cured concrete, asphaltic compounds, brick and masonry, ceramic, glass, steel, and aluminum, and non-inert materials such as clean wood, composition roofing and roofing paper, and minor amounts of metal. Plaster (i.e., sheetrock or plaster board) or any other material, other than clean wood, that is likely to produce gases or leachate during its decomposition process and asbestos waste are not considered to be demolition waste.

D. Land Clearing Waste: Natural vegetation and clean soils from clearing and grubbing land for development such as stumps, brush, weeds, tree branches, tree bark, mud, dirt, sod and rocks.

E. Recycle/Recycling: The process of separating waste materials for remanufacturing or reprocessing into usable or marketable materials. Examples of recycling include separating wood off-cuts for recycling by a wood processor into paper pulp, or separating cardboard, plastic, beverage containers, or miscellaneous metals for recycling.

F. Reuse: To use a construction waste material again in roughly its same form. Materials can be reused on-site or on other projects off-site. Examples of reuse include removing a hardwood floor and reinstalling it in a new project, or using soil from one site as fill on another site.

G. Salvage: To remove a construction waste material or equipment from an existing
building for reuse on-site or reuse on other projects off-site. Items to be salvaged shall be designated by Owner for removal and delivery to Owner.

H. Unacceptable Waste: All waste not authorized for disposal by Owner. This includes any waste that is now or hereafter defined by federal law or by the governing jurisdiction as radioactive, dangerous, hazardous or extremely hazardous waste, unsanitary waste, and vehicle tires in excess or those permitted to be disposed of by the laws of the governing jurisdiction. It does not include any waste destined for salvage, recycling, or general demolition.

I. Waste: All solid waste generated within the limits of the Project, or extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable and recyclable materials, masonry, and concrete.

J. Waste Management Plan: A Project-specific plan for the salvage, collection, transportation, recycling, and disposal of the waste generated at the Project site. A waste management plan includes procedures for separating, storing, and transporting waste and includes methods to assure proper implementation of the plan.

1.03 WASTE MANAGEMENT PLAN

A. Draft Waste Management Plan: Per the Pre-Construction Submittal Requirements of Section 01 33 00, Contractor shall submit to Owner a Draft Waste Management Plan. The Draft Plan shall contain the following:

1. List of materials to be salvaged, materials to be recycled, and materials to be disposition of as solid waste, and dangerous waste.

2. General material handling methods, including segregation and sorting, and placing solid waste into designated containers, on-site storage, and any special procedures for removing and protecting materials.

3. Plan for communicating salvage and recycling requirements on the Project.

4. Dangerous waste identification, accumulation, and disposal management procedures.

5. Materials to be sorted, salvaged, and recycled:
   a. At a minimum, the following types of materials in reusable condition shall be salvaged and sorted. Contractor shall remove and deliver to the Owner at designated location on the Pullman campus.
      1) Dimensional lumber; and
      2) Surplus building materials (new, leftover, unwanted). Review with Owner for clarification.
   b. At a minimum, the following types of materials shall be sorted and included for recycling:
      1) All metals (from banding, stud trim, ductwork, piping, rebar,
roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze);

2) Beverage containers;
3) Cardboard (from supplies and packaging);
4) Clean wood (all unpainted, untreated wood scrap including pallets and engineered wood);
5) Mixed office paper (including blue prints);
6) Film plastic (from shrink wrap and other packaging, and sheeting used as protection or erosion control); and
7) Plate glass.

c. With the exception of unacceptable waste, all materials not designated for salvage or recycle per Paragraph 1.03(A)(5) above, may be co-mingled and disposed of as waste.

B. Dangerous Waste Management:

1. Contractor is responsible for all dangerous waste generated during the Project shall be identified, accumulated and disposed in accordance with WAC 173-303. Contractor generated dangerous waste must be shipped for disposal within 90 Days of generation.

2. Contractor may accumulate dangerous waste in accordance with WAC 173-303 and Washington Department of Ecology Technical Information Memorandum 94-120, Satellite Accumulation. If Contractor accumulates dangerous waste in volume greater than 55 gallons or acutely hazardous waste in a volume greater than one quart, Contractor shall establish and operate a “90-Day” accumulation area in accordance with WAC 173-303.

3. Contractor shall dispose dangerous waste only through vendor(s) approved by Owner. Contractor shall arrange all dangerous waste shipments. Utilization of the vendor and facilities included in the State of Washington Hazardous Waste Disposal contract is authorized. Any other proposed vendor(s) and/or facilities are subject to audit by Owner, prior to utilization. Contractor shall pay for said audits. Contractor shall coordinate with Owner’s Environmental Health & Safety (EH&S) Department for transportation and disposal of all Project generated dangerous waste. EH&S will sign all Uniform Hazardous Waste Manifests.

C. Final Waste Management Plan: Once Owner has reviewed the draft Waste Management Plan and responded with comments or corrections, Contractor shall submit a final plan within 14 Days.

PART 2 PRODUCTS – NOT USED
PART 3 EXECUTION

3.01 WASTE CONTAINMENT

A. Contractor will provide and service containers for all wastes.

B. Contractor shall provide separate waste containers for and properly dispose of all unacceptable waste, including dangerous waste, in accordance with applicable law.

3.02 CONTAMINATION OF WASTE

A. Contractor shall take extraordinary care to ensure construction wastes are properly sorted, segregated, and placed within the correct containers.

B. Should any waste containers designated for salvage, recycle, or general disposal be cross-contaminated with dangerous or unacceptable waste, Contractor shall pay all costs of legally disposing the contaminated waste.

C. Project progress meetings shall include review of construction waste management as an agenda item.

END OF SECTION 01 74 19
PART 1    GENERAL

1.01 PURPOSE

    A. Contractor shall submit advance/draft electronic of Operation & Maintenance manuals (O&Ms) at or immediately following the 80% Application for Payment. Subsequent Applications for Payment will not be processed until an advance/draft copy of the O&Ms has been submitted for review.

    B. Contractor shall submit a final draft of O&Ms on or before Substantial Completion and provide training of Owner's staff in the operation and maintenance of the facility.

1.02 PROCEDURES

    A. Together with a request for Substantial Completion, Contractor shall provide one revised draft electronic version of O&Ms.

    B. To achieve Final Completion, Contractor shall submit:

        1. Two final copies of O&Ms;
        2. A text-searchable PDF electronic file of the O&Ms;
        3. Separate Test & Balance Reports and Telecommunications Test Reports in an independent three ring binder;
        4. A text-searchable PDF electronic file of the Test & Balance Reports and Telecommunications Test Reports.

PART 2    PRODUCTS

2.01 O&M MANUAL MATERIALS

    A. O&M Manuals shall be bound into 3-ring binders (three sets) with the cover and spine to be composed and laid out per the cover page template on the last page of this Section.

    B. The maximum thickness for each manual shall be 3”. Multiple manual sets shall be organized by:

        1. General,
        2. Vertical Transportation,
        3. Mechanical,
        4. Electrical, and
        5. Other (Laboratory Equipment, Special Equipment, etc.).
C. Paper shall be 8 1/2” x 11”, 20 lb. white paper. Divisions within volumes are to be accomplished and annotated with permanently imprinted tabs (insertable indexes are not permitted) which indicate Specification Section numbers only.

D. Copies must be legible. Facsimile transmission copies are not acceptable. Original equipment manufacturer (OEM) printed material is preferred.

PART 3 EXECUTION

3.01 PRODUCTION

A. O&Ms are to be as follows:

1. Table of Contents – a listing of the contents of all volumes. This table of contents shall be inserted at the beginning of each volume in the set.
   a. Identify Contractor, include name, address, phone and fax number, and provide a contact name.

2. Subcontractor List – a list or spreadsheet, organized by Specification Section, of all suppliers and Subcontractors of all tiers who performed Work on the Project. Include the name, address, phone and fax number of Subcontractor or supplier, the Specification Section, and the description of the Work. When Subcontractors perform Work of more than one Specification Section, provide a separate listing of each Specification Section. This listing shall be at the beginning of volume #1 only.
   a. Written certification from Contractor attesting that no asbestos containing products have been incorporated into the Work.

3. Warranty List – a list or spreadsheet containing Contractor’s one-year correction period obligation and all extended (greater than one-year) warranties, organized by Specification Section that indicates:
   a. Item Description (include here special warranty numbers or codes),
   b. Length of warranty,
   c. Specification Section, and
   d. Contractor’s contact information, followed by physical copies of the Contractor’s one-year correction period obligation and all extended warranties. Note that 1-year warranties from Subcontractors are not to be bound into each volume of the O&Ms. This warranty list and attendant warranties shall be at the beginning of volume #1 only, immediately following the asbestos certification.

4. Provide data as outlined in each specification section.

B. Original equipment manufacturer (OEM) information is required to be a part of all equipment information within the O&Ms.
C. Shop Drawings and product data initially submitted for acceptance are generally not acceptable for O&M use (one notable exception is snow melting cable layout drawing – a manufacturer detailed item). Routine Project components such as asphalt, concrete, pipe, fittings, conduit, etc., are not to be included in O&Ms.

END OF SECTION 01 78 23
(O&M cover and spine data on next page)
Facility 4031, Head-House

Mount Vernon Install Head-House

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General
O&M Manual

Vol. X of Y

(Spine and Cover)
PART 1 GENERAL

1.01 PURPOSE AND PROCEDURE

A. Contractor shall submit draft Project Record drawings on or before Substantial Completion. Requests for Substantial Completion will not be considered if submission of Project Record drawings has not occurred.

B. Contractor shall submit final Project Record drawings before Final Completion may be achieved.

PART 2 PRODUCTS

2.01 MATERIALS

A. Project Record drawings are to be red-line markings on original Drawings which clearly indicate the as-built dimensions (both horizontally and vertically) for all installed Work.

B. Identify on Project Record drawings all underground utilities encountered during the Work. Locate these utilities both horizontally and vertically and tie the dimension string(s) back to permanent and visible structures.

C. Clearly label each sheet with the words “PROJECT RECORD DRAWINGS.”

D. Do not affix requests for information (RFIs), change proposals (CCPs) or architectural supplemental instructions (ASIs) to the Project Record drawings. If all or part of a Drawing has been modified, it is acceptable to affix the revised layout over top of the original. However, all dimensions that have been modified are to be red-lined or yellow highlighted.

E. Copies must be legible.

PART 3 EXECUTION

3.01 PRODUCTION

A. During construction, Project Record information will be reviewed not less than monthly concurrent with the monthly review of the draft Application for Payment.

END OF SECTION 01 78 39
PART 1 GENERAL

1.01 DESCRIPTION

A. Owner has set the following indoor air quality requirements for site operations on the Project, within the limits of the Progress Schedule, Contract Sum, and available materials, equipment, products, and services. These include:

1. Protect workers on the site from air quality problems during construction.
2. Prevent indoor air quality problems in the completed facility.
3. Prevent indoor air quality problems in adjacent facilities.

B. To achieve these requirements, Contractor shall develop an “Indoor Air Quality (IAQ) Management Plan” for this Project.

C. Comply with current LEED Reference Guide.

1.02 IAQ MANAGEMENT PLAN MANAGER

A. Contractor shall identify an IAQ Management Plan Manager who will be responsible to monitor construction activities to ensure that the requirements of the IAQ Management Plan are met. The IAQ Manager may also be the Contractor’s Quality Control Manager. The IAQ Manager will be responsible for the following:

1. Draft and submit the IAQ Management Plan to Owner for acceptance.
3. Conduct meetings as required with all participants in the construction process to communicate the IAQ procedures and understand the importance of the requirements of the IAQ Management Plan. If necessary, post signs to ensure workers’ safety.
4. Identify IAQ problems and institute remedial action as necessary.
5. Be present at regular Progress Meetings, as appropriate, and be responsible for providing a monthly written status report as it relates to IAQ for the Project and be prepared to discuss construction related IAQ procedures currently in effect.
6. At time of building flush-out, IAQ Manager shall be the contact person and shall be responsible for overseeing the entire flush-out process.

1.03 IAQ MANAGEMENT PLAN

A. Draft IAQ Management Plan: Submit a Draft IAQ Management Plan within 14 Days after Notice to Proceed, which contains preliminary descriptions of the following procedures for which Contractor is responsible (initial installation, verification that element(s) are in place, daily inspection and upkeep, and
1. List of indoor air quality protective measures to be instituted at Project site, including HVAC system protection during construction and any other control measure applicable to the Project;

2. A plan and schedule for inspection and maintenance of indoor air quality measures;

3. Installation sequencing for porous materials, including paint;

4. Measures to be employed to protect ducts and stored on-site or installed absorptive materials from moisture damage;

5. Type of filtration media used during construction and at time of building flush-out; and

6. Cleanup of contaminated components after construction, but before scheduled flush-out of building ventilation system.

B. Include with the “Draft IAQ Management Plan” written procedures that describe building flush-out process that will be followed upon completion of construction.

C. The Draft IAQ Management Plan shall meet or exceed the minimum requirements of the current Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines.

D. Final IAQ Management Plan: After review and comment on the “Draft IAQ Management Plan,” Contractor shall submit a “Final IAQ Management Plan” that includes the finalized written procedures for above noted elements as well as building flush-out. This final plan and written flush-out procedures shall address all review comments noted on the draft submittal and be submitted prior to the commencement of construction.

1.04 BUILDING FLUSH-OUT SCHEDULE

A. Contractor shall include a separate activity on the Progress Schedule, which indicates the targeted start date and duration of the building flush-out process.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 IAQ MANAGEMENT PLAN IMPLEMENTATION

A. Contractor shall implement and maintain the approved IAQ Management Plan for the duration of the Project and update procedures at any time due to unanticipated building conditions. Contractor shall:

1. Use temporary filtration media during construction to protect HVAC at each return air grille; filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 - 1999.
Isolate the return side of the HVAC system from the surrounding environment as much as possible. Return side shall have the heaviest Work areas dampered off and all return system openings sealed with plastic. Return side shall be shut down and sealed whenever possible.

2. Avoid the use of products, materials and operations that would cause IAQ problems or concerns.

3. Protect the ventilation system components (equipment and ductwork) from contamination, and provide cleaning of the ventilation components, including ductwork exposed to contamination during construction. Protect during transit and installation.

4. Provide ventilation as may be necessary to protect workers’ health and avoid the accumulation of volatile compounds, dust and other harmful airborne contamination.

5. Provide weekly reports and photographs of construction IAQ management measures such as protection of ducts and stored or installed absorptive materials. In each report, describe and illustrate IAQ measures (installation, effectiveness, upkeep, etc.) during construction along with a description of the SMACNA approach employed.

6. Provide data sheets of filtration media used during construction and installed immediately prior to building flush-out and prior to building occupancy.

7. During installation of carpet, resilient flooring, paints, furnishings, and other VOC emitting products, provide supplemental (spot) ventilation for at least 72 hours after Work is completed and describe these activities in the weekly reports.

B. Contractor shall conduct regular inspection and maintenance of indoor air quality measures, including ventilation system protection and ventilation rate.

C. Contractor shall use low-toxic cleaning supplies for surfaces and equipment.

D. When dry sanding for gypsum board assemblies, Contractor shall provide the following protection:

   1. Isolate the space;
   2. Provide plastic sheet separation during sanding;
   3. Close and seal all air system devices and ductwork; and
   4. Sequence the Work to avoid contamination of other spaces with gypsum dust.

3.02 VENTILATION OF CONSTRUCTION FUMES

A. When hazardous chemicals, mineral-spirit based paints, adhesives, or other similar materials are used, the Contractor shall exhaust toxic, noxious, or odor producing fumes from the building in a manner approved by Owner. Contractor's
method of exhaust shall ensure the safety of building occupants and pedestrians in and around the Project site. All supply and return air ductwork within the construction area shall be capped air-tight to prevent distribution of fumes.

3.03 BUILDING FLUSH-OUT

A. Contractor shall conduct a building flush-out with new filtration media at 100% outside air after construction ends and prior to testing, adjusting and balancing of systems. Filtration media shall have a MERV of 13 as determined by current ASHRAE 52.2. This flush-out is different from and additional to the 72-hour flush-outs described in 3.01.A above.

B. Relocate information signs as required by Work progress.

3.04 COMPLETION PROCEDURES

A. Remove all IAQ measures as well as signs, framing, and supports at completion of Project.

B. All testing, adjusting and balancing of systems, including training of Owner personnel, shall be completed after flush-out. All flush-out filtration media must be replaced with required filtration media prior to testing and adjusting of systems.

C. Actual procedures employed during building flush-out must receive prior approval from Owner.

D. Punch list items that do not affect the mechanical systems may be conducted during flush-out upon approval of the Owner.

E. Upon completion of building flush-out, replace all filtration media. Filtration media shall be the same as used for occupancy.

F. Submit a report upon completion of building flush-out stating that all procedures stated in the approved IAQ Management Plan have been complied with. This report shall contain all weekly reports and photographs, as well as any IAQ management plan activities that occurred during the Project.
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Reinforcing Steel
B. Concrete Formwork, shoring and bracing.
C. Cast in place concrete foundations, walls and structure.

1.03 REFERENCES

A. All references shall be the latest adopted edition.
B. American Concrete Institute International:
   1. ACI 117 - Tolerances for Concrete Construction and Materials
   2. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
   3. ACI 301 - Specifications for Structural Concrete for Buildings
   4. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete
   5. ACI 305R - Hot Weather Concreting
   6. ACI 306R - Cold Weather Concreting
   7. ACI 308R – Guide to Curing Concrete
   8. ACI 309R - Guide for Consolidation of Concrete
   9. ACI 315 – Details and Detailing of Concrete Reinforcement
   10. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary
   11. ACI 347R – Formwork For Concrete
   12. ACI 347.2R – Guide for Shoring/Reshoring of Concrete Multistory Buildings

C. ASTM International:
   1. ASTM C33 - Standard Specification for Concrete Aggregates
   2. ASTM C94 - Standard Specification for Ready-Mixed Concrete
   3. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete
5. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
6. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete
7. ASTM C494 - Specification for Chemical Admixtures for Concrete
8. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
9. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars
10. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
11. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
12. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

D. Concrete Reinforcing Steel Institute:
1. CRSI – Manual of Standard Practice

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: For each type of manufactured material and product indicated.

C. Design Mixes: For each concrete mix, submit proposed mix designs minimum of 15 days in advance of placing operations for each type of concrete. Submitted mix designs shall include the following:
1. Supporting test data for mixes shall not be more than 12 months old. Include a sufficient number of tests, conduct a statistical analysis in compliance with ACI 301.
2. Gradation of fine and coarse aggregates not more than 90 days old showing compliance with ASTM C33. No substitutions of aggregate type or size from those submitted shall be allowed.
3. Proportions of all ingredients, including all admixtures added either at time of batching or at job site. Aggregate weights shall be based upon saturated surface dry conditions.
5. Slump as measured according to ASTM C143. Provide slump test for each mix.
6. Air content of freshly mixed concrete as measured according to ASTM C231.
7. Strength measured at 7 and 28 days. Provide strength test for each mix at a frequency of both the 7th and 28th day. Strength shall be tested using 4” diameter X 8” cylinders in accordance with ASTM C31 and ASTM C39.
8. Certifications that all ingredients in each mix are compatible.
9. Locations or intended use of each mix design.
10. Source of all materials.

D. Material Certificates: Signed by manufacturer's certifying that each of the following items complies with the requirements:
   2. Steel reinforcement and reinforcement accessories.

E. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement" and as follows:
   1. Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement.
   2. Include special reinforcement required for openings through concrete structures.
   3. Provide placement details for all specific reinforcing intersections and clearance conditions not shown by the typical details on the structural drawings.
   4. Prepare drawings in sufficient detail to resolve all reinforcing intersections.

F. Embedded Item Placement Drawings: Drawings indicating the location and type of plates, anchorages, or other items to be embedded in the finished concrete surfaces.

G. Coordination Drawings for Mechanical and Electrical penetrations through concrete.

H. ICBO reports for mechanical splice couplers.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: installers shall be experienced and have completed concrete work similar in material, design and extent to that indicated for this project, and whose work has resulted in construction with a record of successful in-service performance.

B. Comply with reference documents unless more stringent provisions are indicated.

C. Perform form work in accordance with ACI 347R, ACI 301, and ACI 318.

D. Perform reinforcing steel installation in accordance with ACI 301.

E. Perform concrete work in accordance with ACI 301 and ACI 318.

F. Follow recommendations of ACI 305R when concreting during hot weather.

G. Follow recommendations of ACI 306R when concreting during cold weather.
H. Testing and Inspection: Testing and inspection shall be in conformance with Section 01 45 00.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store materials in accordance with ACI 301.
   1. Admixtures stored at the project site longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet specified criteria.

B. Deliver, store and handle steel reinforcement to prevent bending and damage.

1.07 COORDINATION AND SEQUENCING

A. Coordinate schedule with other trades where embedments, attachments or interferences occur.

B. Schedule and sequence concrete work to coordinate with fabrication and delivery schedules for items to be embedded in concrete work.

1.08 FIELD MEASUREMENTS

A. Verify that field measurements and conditions are as shown on drawings, shop drawing or as instructed by Product Manufacturer.

1.09 DESIGN RESPONSIBILITY: FORMWORK, BRACING, SHORING & RESHORING

A. Contractor is responsible for designing and engineering formwork along with associated bracing, shoring and reshoring to withstand all imposed construction forces.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Form Materials (for concrete not exposed to view): Provide per ACI 347R at discretion of Contractor.

B. Form Material For Type 1 and 2 Concrete Finish (exposed to view): APA rated B-B High Density Concrete Form Overlay plywood, Class I, conforming to PS 1.
   1. Plywood shall be new, or used once with face free of defects and nail holes filled.

2.02 FORMWORK ACCESSORIES

A. Form Ties: Factory-fabricated cone type, fixed length, removable or snap off metal or glass fiber reinforced plastic form ties designed to break off below face of wall after formwork is stripped.
1. Strength and spacing as required to resist fresh concrete placement and vibration loads and to prevent spalling of concrete on removal.
2. Furnish units that will leave no corrodible metal closer than 1-inch to the plane of the exposed concrete surface.
3. Furnish ties that, when removed, will leave holes not larger than 1-inch in diameter in concrete surface.

B. Shoring And Bracing: Provide materials/system designed by Contractor to withstand all imposed construction forces.

C. Form Release Agent: Colorless, non-staining, shall not adversely affect surface coatings or waterproofing.

D. Corners: Filleted, wood or rigid plastic type; 3/4" x 3/4" inch size; maximum possible lengths.

E. Reveals: Profile, configuration and size shown on Drawings, custom sawn hardwood or rigid plastic type with smooth straight faces and sharp, straight edges and corners; maximum possible lengths.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.03 REINFORCEMENT

A. Reinforcing Steel: As specified in General Notes on the Structural Drawings.

B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
      a. Manufacture bar supports according to CRSI's “Manual of Standard Practice” from steel wire, plastic or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.
      b. Provide plastic or stainless steel chairs and accessories in walls where finish wall surface is exposed to view.
      c. Provide stainless steel or plastic components for placement within 1-1/2” of weathering surfaces.
   3. Mechanical Splices: Where approved by the Engineer, provide ICBO listed mechanical splices of Type 1 or Type 2 as defined by ACI 318. If splice type is not otherwise defined, provide Type 2.

C. Reinforcement - Fabrication
   2. Fabricate in accordance with ACI 315, providing concrete cover as specified or indicated.
3. Bending and straightening in accordance with ACI 318, Chapter 7, unless otherwise noted on the drawings. No bending or straightening of reinforcement permitted after partial embedment in concrete. Heating of reinforcement shall not be permitted unless approved in writing by Structural Engineer.

4. Splicing: Lap splice reinforcing bars for tension with lap lengths as noted on the structural drawings.

5. Welding of reinforcement is permitted only with the specific approval of Structural Engineer. Perform welding in accordance with AWS D1.4.

6. Locate reinforcing splices not indicated on drawings at point of minimum stress. Indicate locations on shop drawings.

2.04 CONCRETE MATERIAL

   1. Provide cement from same source for entire project.

B. Slag Or Flyash:
   1. Slag Or Flyash - Select One Only:
      a. Slag: Ground granulated blast furnace slag conforming to ASTM C989 Grade 100 or 120.
      b. Flyash: Conform to ASTM C618, Class F.
      c. Manufacturers:
         1) Boral Material Technologies, Inc.
         2) Full Circle Solutions, Inc.
         3) Headwater Resources, Inc.
         4) Holcim US, Inc.
         5) Lafarge North America
         6) Mineral Resources Technologies, LLC
         7) Mineral Solutions, Inc.
         8) The SEFA Group

C. Aggregates:
   1. Aggregates: Conform to the requirements of ASTM C33 and subject to the approval of the Structural Engineer.
      a. Do not use high alkaline content aggregates that would prevent slab surface from achieving a pH of 9 or less after curing and dehydration.
      b. Provide aggregate from same source for entire project.
      c. Comply with requirements for limits for deleterious substances and physical property requirements of aggregate per ASTM C33 for severe weathering.

D. Water: Potable and complying with ASTM C94.

2.05 ADMIXTURES

A. Admixtures: As specified in Structural General Notes and the following:
1. Admixtures certified by manufacturer to contain no more than 0.05 percent water-soluble chlorine ions by mass of cementitious material. Do not use admixtures containing calcium chloride or thiocyanate.

2. Where more than one admixture is used in the mix, submit manufacturer’s certification that admixtures are compatible in combination with cement and aggregates.

3. Accelerating admixtures shall not be used.

2.06 CONCRETE ACCESSORIES

A. Bonding Agent: ASTM C1059, Type II acrylic non-redispersable type.

B. Non-Shrink Grout: As specified in General Notes on Structural Drawings.

C. Patching (For finishing concrete exposed to view):
   1. Concrete with Paint Finish: Cementitious Filler, Ardex Tilt Patch or similar having equal or better strength, bonding and finishing characteristics.
   2. Concrete with Natural (No) Finish: Cement Grout, Latex Bond Agent Cement Grout

2.07 JOINT DEVICES AND MATERIALS

A. Waterstops:
   1. Composite Bentonite and butyl rubber waterstop; Volclay Waterstop-RX or approved.
   2. PVC with heat/chemically welded seams.

2.08 CONCRETE MIX DESIGN

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mixtures or field experience according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for laboratory trial mix basis.

C. Concrete mix design: comply with Structural Drawing requirements.

D. Provide percentage by weight of cementitious materials other than Portland Cement in concrete.

E. Minimum Requirements:
   1. Provide minimum cement content per ACI 301.
   2. Provide air-entrainment per ACI 301 or 2 percent minimum, whichever is greater. Footings and walls shall be considered severe exposure.
F. Limit water soluble chlorine ion content in hardened concrete to 0.15 percent by weight of cement.

G. Use admixtures according to manufacturer’s written instructions.

H. Maximum aggregate size is one-inch for walls.

2.09 MIXING

A. Transit Mixers: Measure, batch, mix and deliver concrete according to ASTM C94, furnish batch ticket information.
   1. Batch Tickets: Include amount of water in batch from plant and remaining water that may be added at site, if any.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate and facilitate installation of embedded structural items.

C. Coordinate and adjust concrete mix and additives to comply with requirements of manufacturers of coatings, sealants and adhesives applied to concrete.

D. Coordinate and facilitate rough-in, openings and penetrations for Mechanical and Electrical items in concrete construction with Divisions 20 through 28.

3.02 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.03 FORMWORK - ERECTION

A. Erect formwork, shoring and bracing to achieve design requirements in accordance with the requirements of ACI 301. Construct formwork so concrete members and structures are of size, shape, alignment, elevation and position indicated within the tolerance limits of ACI 117.

B. Provide bracing to ensure the stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads to provide support and limit deflection of formwork to specified criteria.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
D. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Coordinate this Section with other sections of work that require attachment of components to formwork.

G. Set edge forms, bulkheads and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Form openings, chases, offsets, keyways and bulkheads required in work. Provide and secure units to support screed strips. Use strike-off templates or compacting-type screeds.

3.04 FORMWORK - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
   1. Protect reinforcing steel, inserts and bonding surfaces from application of any form release agent.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by form release agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 FORMWORK - INSERTS, EMBEDDED WORK, AND OPENINGS

A. Provide formed openings required for work by other trades and items passing through concrete work.

B. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions and directions furnished with items to be embedded.
   1. Install anchor bolts, accurately located, to elevations required.
   2. Install connection plates, angles, or other embedded items flush with concrete surface and at accurate locations per the approved embedded item placement drawings required in the “Submittals” article.

C. Locate and set in place items that will be cast directly into concrete.

D. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement.

3.06 FORMWORK - CLEANING

A. Clean forms as erection proceeds, remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.
   1. Flush with water or use compressed air to remove remaining foreign matter. Ensure water and debris drain to exterior through clean-out ports.
   2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

C. Clean and repair surfaces of forms to be reused in the work.

3.07 FORMWORK - TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301 and so that concrete members and structures are of size, shape, alignment, elevation and position indicated within the tolerance limits of ACI 117.

3.08 FORMWORK - REMOVAL

A. Formwork for sides of beams, walls, columns, foundations and similar parts of the work that does not support the weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is hard enough to not be damaged by form removal operations and provided curing and protection operations are maintained.

B. Leave formwork for beam soffits, slabs, joists and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.

C. Comply with ACI 301 and ACI 318 recommendations in ACI 347R and ACI 347.2R for design, installation and removal of shoring and reshoring.

3.09 REINFORCEMENT - PLACEMENT

A. Comply with CRSI's “Manual of Standard Practice” for placing reinforcement.

B. Clean reinforcement of loose mill scale, earth, ice and other foreign matter.
C. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain concrete cover and position.

D. Defective Work: The following reinforcing steel work will be considered defective, and shall be removed and replaced:
   1. Bars with kinks or bends not shown in the drawings
   2. Bars damaged due to bending or straightening
   3. Bars heated for bending
   4. Reinforcement not placed in accordance with the drawings.

E. Accommodate placement of formed openings.

F. Bend all tie wire back behind line of rebar on weathering surfaces.

G. Conform to applicable code for concrete cover over reinforcement.

3.10 CONCRETE - PREPARATION

A. Verify forms are clean and free of rust before applying release agent.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

C. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

3.11 CONCRETE - PLACEMENT

A. Place concrete in accordance with ACI 304R, vibrate concrete thoroughly to eliminate voids, air pockets and rock pockets.
   1. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
   2. Do not over-vibrate or use improper vibration methods or equipment that result in “bug holes” on face of concrete exposed to view.

B. Before placing concrete, water may be added at project site only up to amount listed on batch ticket, subject to limitations of ACI 301. Total water in mix at time of placement shall not exceed amount specified in mix design. Do not add water to concrete after high range water-reducing admixtures have been added to mix at project site.

C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices are in place and will not be disturbed during concrete placement, and all required inspections have been performed.

D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams
or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

E. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

F. Cold Weather Placement: As specified in General Notes on the Structural Drawings.

G. Hot Weather Placement: As specified in General Notes on the Structural Drawings.

H. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.12 CONCRETE - FINISHING

A. Top Of Footings or Foundation Walls: Float finish top of concrete footing and foundation walls to a smooth, straight, level surface free of variations of top elevation exceeding 1/4” in 10'-0”.
   1. Where top of footing will receive sheet waterproofing, finish surface smooth to tolerances required by waterproofing manufacturer.

B. Repair surface defects, including tie holes, immediately after removing formwork.

C. Concrete Concealed From View: Rub down or chip off fins or other raised areas 1/8” or more in height and grout fill rock pockets.

D. Concrete Finish Where Exposed To View:
   1. Rub down or chip off and smooth fins or other raised areas and grind smooth.
   2. Break open and expose shallow air pockets and “bug holes” that occur on face of concrete.
   3. Fill form tie holes, air pockets, “bug holes”, voids, rock pockets and any uneven or irregular areas with latex bonding agent enriched cement grout.
   4. Bare (natural) Concrete: Cement grout shall match concrete color.

E. Concrete Finish Where Exposed To View – Grout Cleaned Finish (sacked finish):
   1. Rub down or chip off and smooth fins or other raised areas and grind smooth.
   2. Break open and expose shallow air pockets and “bug holes” that occur on face of concrete.
   3. Fill form tie holes, air pockets, “bug holes”, voids, rock pockets and any uneven or irregular areas with latex bonding agent enriched cement grout matching concrete color.
   4. Wet areas to be cleaned and apply Portland cement grout mixture by brush or spray; work grout into voids and roughness; scrub immediately
with burlap or course cloth to remove excess grout; leave surface smooth and uniform in appearance.

5. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

F. Concrete Exposed To View – Smooth Finish: Finish to a smooth, flat plane surface:
1. Grind off any fins, ridges or raised areas to establish a flat plane.
2. Break open up any subsurface air holes or voids.
3. Fill rock pockets, air holes or voids and form tie holes with latex bonding agent enriched cement grout.
4. Fill entire surface with Ardex Tilt Patch to fill all voids, roughness, etc., overfill edges of reveals and corners.
5. Grind/sand entire surface smooth with fine grit grinder that does not leave any grinder marks; grind edges of reveals and corners accurately to achieve sharp edge, straight lines.
6. Finish appearance shall be a flat plane free of any ridges, grinder tracks or imperfections with a perfectly smooth finish and straight crisp reveal and corner lines.

G. Surfaces To Receive Waterproofing: Rub down entire surface and chip off all fins, grind rough areas smooth, fill tie holes, rock pockets, voids, air holes, “bug holes”, etc. with cement grout flush with adjacent surfaces, prepare surface in accordance with waterproofing manufacturer’s requirements.

3.13 CONCRETE - CURING AND PROTECTION

A. Cure concrete in accordance with ACI 308; leave forms in place for as long as practicable after pouring concrete, but in no case less than 3 days. Coordinate with 3.08 above.
1. Cure concrete long enough to ensure that 100% of the specified value for concrete properties are developed at 28 days.

B. Protect concrete from damage after forms are removed; do not damage surface of concrete during removal of forms.

3.14 WORKMANSHIP

A. Concrete shall be installed using the best workmanship, including the following:
1. Exposed to view wall surfaces free of waviness or deflection from inadequate form construction.
2. No tie wire or reinforcement within 1 inch of any concrete surface.
3. Corners aligned plumb and straight with consistent appearance.
4. Reveals in straight alignment.
5. Proper consolidation of concrete, free of rock pockets or voids.
6. Walls aligned straight, plumb and in a flat plane.
7. No unplanned horizontal cold joints within walls.
3.15 FIELD QUALITY CONTROL

A. Refer to Structural Drawings for special inspection and testing requirements for concrete work and including the following:

1. Inspect reinforcing steel materials and placement for conformance to Contract Documents prior to placement of any concrete.

2. Inspect and test concrete for conformance to Contract Documents, including:
   a. Confirmation of proper design mix
   b. Visual inspection of concrete during placement
   c. Slump testing
   d. Compression testing
   e. Percentage of entrained air testing
   f. Determination/confirmation of water/cement ratio

B. An independent testing agency will perform field quality control tests as specified in Section 01 45 00. Testing agency shall be qualified according to ASTM C1077 and ASTM E329 to conduct testing indicated.

1. Contractor shall:
   a. Submit proposed concrete mix design of each class of concrete to agency for review prior to commencement of concrete operations.
   b. Coordinate and schedule inspection and testing of reinforcing steel and concrete work by the agency at the appropriate times and prior to cover.
   c. Provide testing agency with access to the work to allow required inspections and testing.
   d. Correct deficiencies or remove and replace any work that inspections and test reports indicate do not comply with specified requirements.

2. Tests taken are spot checks only at a given location and shall not be interpreted as representing the quality or integrity of all of the concrete work performed.

3. Test data and reviews shall not be construed as acceptance of the work by the testing agency nor shall it relieve the Contractor of his responsibility to replace non-conforming or failed work.

4. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

END OF SECTION
SECTION 03 30 01

CONCRETE FLOOR SLABS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Formwork, reinforcing, placement, finishing and curing for concrete floor slabs.

B. Shoring and bracing

C. Underslab vapor retarder sheet

1.03 REFERENCES

A. All references shall be the latest adopted edition.

B. American Concrete Institute International:
   1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International
   2. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International
   3. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International
   4. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International
   5. ACI 305R - Hot Weather Concreting; American Concrete Institute International
   6. ACI 306R - Cold Weather Concreting; American Concrete Institute International
   7. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International

C. ASTM International:
   1. ASTM C33 - Standard Specification for Concrete Aggregates
   2. ASTM C94 - Standard Specification for Ready-Mixed Concrete
   4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete
5. ASTM C494 - Specification for Chemical Admixtures for Concrete
6. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
8. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

1.04 SUBMITTALS

A. Refer to Section 01 33 00, for submittal procedures.

C. Product Data:
   1. Submit product data for concrete design mix(s) from concrete supplier for each different floor slab condition.
   2. Under slab vapor retarder.

D. Design Mixes: For each concrete mix, submit proposed mix designs a minimum of 15 days in advance of placing operations for each type of concrete. The submitted mix designs shall include the following:
   1. Supporting test data for mixes that is not more than 12 months old. Include a sufficient number of tests and conduct a statistical analysis in compliance with ACI 301.
   2. Gradation of fine and coarse aggregates not more than 90 days old showing compliance with ASTM C33.
   3. Proportions of all ingredients, including all admixtures added either at the time of batching or at the job site. Aggregate weights shall be based upon saturated surface dry conditions.
   5. Slump as measured according top ASTM C143. Provide slump test for each mix.
   6. Air content of freshly mixed concrete as measured according to ASTM C231.
   7. Strength measured at 7 and 28 days. Provide strength test for each mix at a frequency of both the 7th and 28th day.
   8. Certifications that all ingredients in each mix are compatible.
   9. Locations or intended use of each mix design.
   10. Source of all materials.

E. Material Certificates: Signed by manufacturer's certifying that each of the following items complies with the requirements:
   2. Steel reinforcement and reinforcement accessories.
   3. Curing materials.
F. Joint Layout Shop Drawings: Indicate proposed layout for control joints.

G. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement prepared according to ACI 315, “Details and Detailing of Concrete Reinforcement” and as follows:
   1. Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement.
   2. Include special reinforcement required for openings through concrete structures.
   3. Provide placement details for all specific reinforcing intersections and clearance conditions not shown by the typical details on the structural drawings.
   4. Prepare drawings in sufficient detail to resolve all reinforcing intersections.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Acquire cement from same source and aggregate from same source for entire project.

C. Perform reinforcing steel installation in accordance with ACI 301.

D. Follow recommendations of ACI 305R when concreting during hot weather and as specified in General Notes on the Structural Drawings

E. Follow recommendations of ACI 306R when concreting during cold weather and as specified in General Notes on the Structural Drawings.

1.06 PROJECT CONDITIONS

A. Unless adequate protection is provided and acceptance is obtained, concrete shall not be placed during rain, sleet, or snow.

B. Rainwater shall not be allowed to increase mixing water nor to damage surface finish.

B. When temperature of surrounding air is expected to be below 40 degrees F during placing or within 24 hours after placing, temperature of plastic concrete, as placed, shall be no lower than 55 degrees F for sections less than 12 inches in any dimension nor 50 degrees F for any other sections. Temperature of concrete as placed shall not exceed 90 degrees F.

1.06 CONTRACTOR RESPONSIBILITY

A. Contractor is responsible for designing and engineering the formwork along with the associated bracing and shoring to withstand all imposed construction forces.
B. Contractor is responsible for coordinating and controlling the installation and protection of the entire concrete slab assembly including the Underslab capillary break selection, selection of concrete design mix conforming to design criteria, control of water added to concrete on the site, placement of concrete, slab finishing methods, slab curing methods and dry-out of the concrete slabs so as to achieve a crack-free slab with surface finish, vapor emission rate, moisture content and pH level required for and by the floor covering manufacturer(s) for successful application of their products.

PART 2 - PRODUCTS

2.01 FORMWORK MATERIALS

A. Form Materials (for concrete not exposed to view): Provide per ACI 347R at discretion of Contractor.

B. Form Material For Type 1 and 2 Concrete Finish (exposed to view): APA rated B-B High Density Concrete Form Overlay plywood, Class I, conforming to PS 1.
   1. Plywood shall be new, or used once with face free of defects and nail holes filled.

2.02 FORM ACCESSORIES:

A. Shoring And Bracing: Provide materials/system designed by Contractor to withstand all imposed construction forces.

B. Form Release Agent: Colorless, non-staining, low or no VOC, will not adversely affect surface coatings or waterproofing.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.03 INSERTS & EMBEDS

A. Inserts And Embeds: Steel or ductile iron as specified on Structural Drawings, type and configuration suitable for intended load/connection and rated for intended load with generous margin of safety.

B. Anchorbolts: As specified on Structural Drawings.

2.04 REINFORCEMENT

A. Reinforcing Steel and Welded Wire Mesh: As specified in General Notes on the Structural Drawings.
B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Where reinforcement is installed over underslab vapor retarder, provide metal or concrete support pads that will not damage the vapor retarder.
      a. Provide stainless steel or plastic components for placement within 1-1/2" of weathering surfaces.

C. Fabrication:
   1. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
   2. Welding of reinforcement is permitted only with the specific approval of Structural Engineer. Perform welding in accordance with AWS D1.4.
   3. Locate reinforcing splices not indicated on drawings at point of minimum stress.

2.05 CONCRETE MATERIALS

A. Cement: As specified in General Notes on the Structural Drawings.

B. Slag Or Flyash:
   1. Slag Or Flyash - Select One Only:
      a. Slag: Ground granulated blast furnace slag conforming to ASTM C989 Grade 100 or 120.
      b. Flyash: Conform to ASTM C618, Class F.
      c. Manufacturers:
         1) Boral Material Technologies, Inc.
         2) Full Circle Solutions, Inc.
         3) Headwater Resources, Inc.
         4) Holcim US, Inc.
         5) Lafarge North America
         6) Mineral Resources Technologies, LLC
         7) Mineral Solutions, Inc.
         8) The SEFA Group

D. Aggregates:
   1. Aggregates: Conform to the requirements of ASTM C33 and subject to the approval of the structural engineer.
      a. Do not use high alkaline content aggregates that would prevent slab surface from achieving a pH of 9 or less after curing and dehydration.

E. Water: Potable and complying with ASTM C94

2.07 ADMIXTURES

A. Admixtures: As specified in General Notes on the Structural Drawings.
1. Water-Reducing Admixture – Super Plasticizer: Conform to ASTM C494, Type F, provide water reducing, super-plasticizing admixture to concrete mix as required to maintain the water/cement ratio specified herein and improve workability and slump required for proper placement, consolidation and finishing.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Provide concrete mix design that will result in concrete as specified in the General Notes on the Structural Drawings and this Section. Comply with ACI 211.1 recommendations. In addition to the requirements of the General Notes on the Structural Drawings, conform with the following special requirements:
   1. Water/Cement Ratio: 0.40 or less; add water-reducing admixture as required to achieve.
   2. Concrete shall not contain high alkaline content aggregates that would prevent slab surface from achieving a pH of 9 or less after curing and dehydration.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C94.

2.10 CONCRETE ACCESSORIES

A. Bonding Agent: ASTM C1059, Type II acrylic non-redispersable type.

B. Non-Shrink Grout: As specified in General Notes on the Structural Drawings.

2.11 UNDERSLAB VAPOR RETARDER FOR SLAB ON GRADE

A. Vapor Retarder: 15 mil polyolefin or HD polyethylene film manufactured from virgin resins; conforming to ASTM E1745 Class A; 0.3 perms or less when tested in accordance with ASTM E96 and F1249; the following products are acceptable:
   1. Stego Industries, LLC Stego Wrap 15 Mil, phone: (877) 464-7834
   2. Reef Industries Griffolyn 15 Mil Green, phone: (800) 231-6074
   3. Fortifiber Moistop Ultra 15, phone: (800) 773-4777
   4. WR Meadows, Inc Perminator 15 Mil, phone: (800) 342-5976
   5. Insulation Solutions, Inc. Viper VaporCheck II 15-mil, phone: (866) 698-6562
   6. Raven Industries “Vapor Block”; Insulation Solutions, Inc. – “Viper 2”

B. Accessories For Underslab Vapor Retarder:
   1. Seam Tape: Provide manufacturer’s recommended tape for sealing seams.
   2. Mastic/Sealant: Vapor retardant mastic or sealant recommended by vapor retarder manufacturer for sealing vapor retarder to perimeter walls and sealing seams.
3. Boots At Pipe/Conduit Penetrations: Construct pipe boots from vapor retarder material and seam tape or mastic in accordance with manufacturer's instructions.

C. Bonding Agent: ASTM C1059, Type II acrylic non-redispersable type.

D. Non-Shrink Grout: As specified in General Notes on the Structural Drawings.

2.12 CONSTRUCTION & CONTROL JOINT ACCESSORIES

A. Sealant Filled Control Joints – Slabs Exposed To View: Rigid expansion joint filler conforming with ASTM D1751 or D1752 as required by sealant manufacturer.
   2. Joint Width: 1/2 inch.

B. Control Joints – Slabs Concealed From View: T-shaped vinyl control joint.
   1. W.R. Meadows Speed-E-Joint
   2. Zip Strip
   3. Or similar

C. Expansion/Isolation Joints: Furnish resilient bituminous type. Conform to detail and thickness as shown on drawings.
   1. Sternson Ltd. Flexcell
   2. Grace Construction Products Fiber
   3. Homosote Co. Homex 300
   4. Old North Mfg. Co., Inc. Gray-Flex
   5. Or approved, non-extruding type, full depth of slab as required to bring top to within 1/4 inch of surface of slab, conforming to ASTM D1751.

2.13 SCREED SYSTEM

A. Select a screed support system that does not penetrate or damage the underslab vapor retarder while providing the level control required to achieve specified floor slab surface tolerances.
   1. Screed System: Grann Adjustable Quick Screed (800.554.7266), or similar screed chairs from either Dayton Richmond (800.745.3700) or Aztek (877.531.3344)

B. Coordinate flush pipe and conduit penetrations through slab with Divisions 20 through 28 if required to accommodate screed system selected.

2.14 CURING MATERIALS

A. General: Refer to Curing Schedule in Part 3 of this Section.

B. Type 1 Curing – Water Curing: Select from the following options as appropriate
Revision

for conditions:
1. Option 1 - Continuous Water Curing: Provide water spray equipment to cover entire slab area.
2. Option 2 – Sheet/Blanket Curing: Curing sheet consisting of white polyethylene sheet with water retaining polyester fabric or natural cellulose fiber backing.
   a. PNA HydraCure S16 or M5, phone: (800)-542-0214.
   b. McTech Group UltraCure SUN, phone: (866) 913-8363.
   c. Cold Weather Curing: Whenever there is the potential for freezing temperatures or frost occurring after concrete slabs are placed at any time during the curing period, provide heated enclosure around/over slab or install reinforced polyethylene sheet blanket filled with polypropylene foam insulation or other type of insulating blanket over the curing sheet to protect slabs from freeze damage.

C. Type 2 Curing: Liquid-type containing minimum 16% acrylic solids, clear acrylic, copolymer curing compound, sealer, dustproofer and hardener conforming to ASTM C309, Type I, Class A and B; Euclid Aqua-Cure VOX OR Sealer:
   “Surebond SB-7000” as manufactured by Sure Bond Company, info@surebond.com, 888-447-8731 OR approved substitutions.

PART 3 - EXECUTION

3.01COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate and facilitate recessed concrete slab construction to meet requirements of tile flooring.

C. Coordinate and facilitate concrete slab construction to meet requirements of floor covering manufacturers.

D. Coordinate and adjust concrete mix and additives to comply with requirements of manufacturers of coatings, sealants and adhesives applied to concrete.

E. Coordinate and facilitate rough-in, openings and penetrations for mechanical and electrical items in concrete construction with Divisions 20 through 28.

F. Coordinate and facilitate floor slab slope and heights of floor drains with Division 22 to assure adequate drainage.

3.02EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.
3.03 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

C. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer’s instructions.
   1. Utilize screed system for slabs with underslab vapor retarder that does not penetrate or damage the vapor retarder.

3.04 FORMWORK

A. Edge Forms:
   1. Construct edge forms and bracing, for slabs on grade, metal floor decking and decks with waterproof membrane to achieve design requirements, in accordance with requirements of ACI 301.
   2. Arrange and assemble forms to permit dismantling and stripping so as to avoid damage to concrete during stripping.
   3. Apply form release agent on forms in accordance with manufacturer's recommendations.
      a. Protect reinforcing steel, inserts and bonding surfaces from application of any form release agent.

B. Screeds: Utilize a screed system to facilitate placement of concrete to a uniform flat plane; with uniform slope where shown or required for drainage.

C. Inserts, Embedded Work and Openings
   1. Provide formed openings for work by other trades and items passing through concrete work.
   2. Locate and set in place items that will be cast directly into concrete.
   3. Coordinate with work of other sections in forming and placing openings, slots, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
   4. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

D. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

3.05 REINFORCING STEEL PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
B. Do not displace or damage underslab vapor retarder.
C. Accommodate placement of formed openings.
D. Conform to applicable code for concrete cover over reinforcement.

3.06 UNDERSLAB VAPOR RETARDER INSTALLATION

Install continuous vapor retarder sheet under interior slabs on grade, place over the capillary break and directly under concrete slab.
1. Extend sheet to top of slab at perimeter of slab and adhere to wall with manufacturer's recommended mastic or sealant.

B. Lap joints minimum 6 inches and seal watertight by continuously sealing edges and ends using vapor retarder manufacturer's recommended tape or seal.
C. Install a watertight "boot" (may be manufacturer's prefabricated boot or site fabricated from a piece of vapor retarder) around all pipe penetrations through slab. Extend boot to top of slab elevation and seal edges of "boot" to vapor retarder watertight using manufacturer's recommended tape or sealant.

D. Protect vapor retarder from damage during construction.
E. Seal all cuts and holes in vapor retarder with a patch of the same material, sealed full perimeter watertight.

3.07 CONTROL OF CONCRETE SLAB CONSTRUCTION

A. Coordinate and control the installation and protection of the entire concrete slab assembly including the Underslab capillary break, selection of the concrete design mix, water added to concrete on the site, placement of concrete, slab finishing methods, slab curing methods and dry-out of the concrete slabs so as to achieve a crack-free slab and the surface finish, vapor emission rate, moisture content and pH level required for and by the floor covering manufacturer(s) for successful application of their products.

B. Select and provide the equipment and power/fuel required to dry out concrete floor slabs to required moisture content and vapor emission rate required for the successful installation of any floor covering or coating being applied.

3.08 CONSTRUCTION & CONTROL JOINTS

A. Construction Joint Layout: Coordinate proposed construction joint layout with Architect and Structural Engineer prior to placement of any concrete within the apparatus bays.

B. Construction Joints: Construct full depth keyed form in configuration shown on Drawings or as approved by Architect.
1. Remove temporary forms carefully and protect exposed edge of concrete from damage.

C. Control Joints:
   1. Control Joints – Slabs Exposed To View: Install removable top sealant filled control joint; align straight and true.
   2. Sealant specified in Section 07 90 00.
   3. Control joint filler specified in Section 03 33 13.

D. Tooled/Scored Control Joints: Tooled joints made in wet concrete, with uniform appearance, straight and true, depth as follows:
   1. Joints shall be straight and true.

3.09 TOLERANCES

A. Floor Slab Surface Tolerances: Floor slabs shall be constructed to achieve the following tolerances when measured in accordance with ACI 302.1R:
   1. Maximum Variation of Surface Flatness For Concrete Floors: 1/4 inch in 10 feet.

3.10 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

D. Protect underslab vapor retarder from damage during concrete placement. Repair vapor retarder damaged during placement of concrete reinforcing or concrete. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

E. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

F. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

G. Place concrete continuously between predetermined expansion, control, and construction joints.

H. Do not interrupt successive placement; do not permit cold joints to occur.
I. Place floor slabs with joint locations as shown on the Drawings or, where not shown, as approved by Architect.

J. Screed floors to a level flat plane, maintaining specified surface flatness.

K. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on Drawings or as directed by Architect (minimum 1/8” per foot nominal). Ponding water around drains is not acceptable.
   1. Floors Without Floor Covering: Surface of concrete adjacent to floor drain shall be 1/16” to 3/32” above top of floor drain and shall not pond water, transition slope to edge of floor drain shall be smooth without a sharp edge/drop-off.
   2. Floors With Floor Covering: Hold top of concrete below top of grate to allow floor covering to install flush with top of drain grate. Coordinate height of drain grate to match floor covering.

L. Where there are walls or permanent cabinets with bases to be installed after slab is placed, the floor slope should be started at the wall or cabinet base location.

3.11 FLOOR FINISHING

A. General: Finish concrete floor surfaces with bull float, wood/magnesium hand floats and steel trowels in accordance with ACI 301 and ACI 302.1R.
   1. Do not dust slab with cement powder while finishing.

B. Steel Trowel Finish - Floors Scheduled To Receive Floor Covering & Interior Concrete Floors Exposed To View: Steel trowel surfaces to a smooth finish, free of ripples or surface defects and that conforms to the floor covering manufacturer's requirements.
   1. Do not over trowel or "burn" the slab surface, excessive power troweling can densify the slab surface to such a high degree that the rate of water release from the slab is hindered and the time required to dry out the full depth of the concrete slab (as required for application of adhesively applied floor coverings) is increased substantially.

3.12 CURING

A. Curing Schedule: Cure floor slabs in the following location as noted:
   1. Slabs With Floor Covering or Coating: Type 1 Curing – Continuous Water Curing or Curing Sheet/Blanket.
   2. Slabs Exposed To View With No Finish: Type 2 Curing – Liquid Curing/Sealing Compound.

B. Cure concrete slabs in accordance with ACI 308 and the following to properly moisture cure the concrete and to reduce/eliminate uncontrolled shrinkage cracking.
   1. Type 1 Curing - Continuous Water Curing or Curing Sheet/Blanket:
      a. Continuous Water Cure: Set up water spray equipment to
maintain concrete slabs in a continuously wet condition for the entire curing period.

1) Install timers or other methods on spray equipment to allow timed spray operation prevent overwatering of the site.

2) Slabs shall not be allowed to dry out for the entire curing period.

b. Curing Sheet/Blanket: Place over entire slab in conformance with manufacturer’s installation instructions and the following

1) After finishing is complete and prior to slab drying in any area, thoroughly wet the entire slab with a continuous film of water sufficient to completely saturate the backside of the curing membrane when unrolling.

2) Unroll moisture retaining curing sheet continuously over wet slab to trap surface water and maintain slab in damp condition during curing.

3) Overlap sheet edges and ends 4 inches and secure edges with framing lumber to prevent wind from blowing curing sheet off slab.

4) Extend sheet 8 inches beyond perimeter of slab and secure sheet tightly at slab perimeter with framing lumber to prevent wind from blowing curing sheet off slab.

5) Use a roller to remove any air bubbles.

6) Maintain sheet in place in undamaged condition for 7 days minimum and until concrete design strength is achieved; repair any damage to sheet immediately.

2. Liquid Type Curing/Sealing Compound:

a. Apply 2 separate coats of curing and sealing compound to concrete slabs as soon as final finishing operations are complete (immediately after surface water sheen has disappeared) in strict conformance with manufacturer’s installation instructions.

b. Apply uniformly at manufacturer’s recommended application rate for uniform and complete coverage in continuous operation by power spray or roller.

c. Recoat areas subjected to heavy rainfall within 3 hours after initial application.

d. Maintain continuity of coating and repair damage during curing period.

3.13 FIELD QUALITY CONTROL

A. Refer to Structural Drawings for special inspection and testing requirements for concrete work.

An independent testing agency will perform field quality control tests, as specified in Section 01 45 00. Testing agency shall be qualified according to ASTM C1077 and ASTM E329 to conduct testing indicated.

C. Provide testing agency with safe access to concrete operations at project site
and accommodate their requirements.

E. Concrete Mix Design: Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

F. Reinforcing Steel: No concrete shall be placed until placement of reinforcing steel has been inspected and approved. Inspector shall inspect/verify:
   1. Material type, grade, size and configuration of reinforcing being placed.
   2. Any additional items required by the structural drawings.

G. Continuous Field Inspection: The independent testing agency shall be present at all times during the placing of structural concrete. Work shall not proceed until all inspections are completed. Prior to placing concrete, the Inspector shall inspect:
   1. Accuracy, configuration and cleanliness of all formwork.
   2. Quality, cleanliness and placement of all reinforcing steel.
   3. Check batch tickets for compliance with required mix design(s).
   4. Any additional items required by the structural drawings.

H. Concrete Sampling:
   1. Obtain and test samples in accordance with ACI 301.
   2. Mold and cure a minimum of 6 compression test specimens for each sample. Test specimens at intervals noted in ACI 301.
   3. At contractor’s expense and direction, cast and field-cure standard cylinder specimens as may be required for construction. Number of specimens and testing age shall be determined by the contractor based on construction sequence requirements.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Preparation of concrete floor slabs to receive coatings, floor coverings, adhesives or floor/roof coverings; including the following:
   1. Drying concrete slab to required moisture vapor transmission rate.
   2. Contractor hired testing laboratory to test slab moisture content, vapor emission rate and pH level.
   3. Correcting rough or out of tolerance slabs.
   5. Correcting concrete slabs with non-conforming pH levels.
   6. Installing joint filler in control and construction joints.

1.03 REFERENCES

A. All references shall be the latest adopted edition.

B. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.


D. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.04 ENVIRONMENTAL REQUIREMENTS

A. The roof must be installed and all exterior openings closed in.

B. Areas shall be maintained in a heated and dry condition.

C. Starting at least 48 hours prior to taking any tests, maintain temperature in areas to receive floor covering at 70 degrees F during any testing.
PART 2 - PRODUCTS

2.01 DRYING EQUIPMENT

A. Provide fans, heaters, dehumidifiers, etc. as required to dry out the concrete slabs to required level.
   1. Heating equipment is limited to electric heaters or indirect-fired gas, oil or kerosene fired units with exhaust piped to building exterior. Direct fired gas, oil or kerosene heaters are not allowed.

B. Provide temporary enclosure(s) as required to protect the concrete slab from exposure to the weather or from becoming wet from other sources.

2.02 TESTING AGENCY

A. Testing Agency: Contractor shall hire a qualified independent testing agency to perform the testing specified in this Section for all concrete slabs scheduled to receive adhered roofing, floor coatings or coverings:
   1. Testing by floor coating/covering installers is encouraged, but shall not be an acceptable substitute for the independent testing agency specified herein.

B. Equipment: Provide the testing materials and equipment required by each different ASTM test method or test procedure; testing equipment shall be calibrated and tested for accuracy within the previous 12 months by a recognized independent test facility.

2.03 CEMENTITIOUS UNDERLAYMENT

A. Cementitious Underlayment/Subfloor Filler: Portland cement-based underlayment formulated specifically for patching and filling concrete slabs on grade, 4,200 psi compressive strength; capable of feather edge installation; not adversely affected by moisture or alkali.
   1. Manufacturer/Product: Ardex SD-P InstantPatch or similar with equal or better compressive strength and performance characteristics.

2.04 JOINT FILLER

A. Interior Concrete Floor Slab Joint Filler: Semi-rigid, two-part, self-leveling, 100% epoxy filler; Shore A hardness of at least 80; minimum 450 psi tensile strength.
   1. Manufacturers/Products:
      a. Dayton Superior Poxy-Fil
      b. Euclid Chemical Co. Dural 340 SL
      c. L&M Construction Chemicals, Inc. Epoflex SL
   2. Applications: Use for:
      a. Control and construction joints in interior concrete slabs.

2.05 MOISTURE BARRIER

A. Moisture Barrier:
1. The need for a moisture barrier is determined by the Contractor based on:
   a. Contractor’s project scheduling
   b. Contractor’s ability to manage the installation and protection of the underslab vapor retarder and to control the placement and drying of the concrete slabs so that the concrete is sufficiently dry and the water vapor emission rate is at or below the level required by the floor coating or covering manufacturer(s).

2. The selection of moisture barrier product(s) shall be based on moisture emission rate test results and the moisture barrier manufacturer’s requirements/limitations for their products.

3. Moisture Barrier: Select a moisture barrier manufacturer/product that conforms to the following:
   a. Moisture barrier shall be compatible with and approved for use with the coatings, adhesives and floor covering products being installed on this Project.
   b. Moisture barrier system shall reduce the concrete slab moisture vapor transmission rate to the level required to meet the floor coating/covering manufacturer’s requirements.
   c. Moisture barrier manufacturer shall warrant the entire floor coating/covering or roofing installation to be free from failure due to the floor slab exceeding the manufacturer’s required moisture vapor transmission rate for a period of 5 years minimum, including removal and replacement of any failed coating/flooring/roofing with equivalent coating/flooring/roofing at no cost to the Government.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate concrete placement, finishing and curing/drying requirements with Section 03 30 01.

C. Inspect the surface finish and tolerances on the concrete slabs with the finish flooring installer(s) and identify any areas that are not acceptable for installation of their products.

D. Coordinate requirements for preparation of floor slabs scheduled to receive adhered roofing system to conform with roofing manufacturer’s requirements.

E. Coordinate requirements for preparation of floor slabs scheduled to receive floor covering to conform with each different floor covering manufacturer’s requirements.
F. Coordinate requirements for preparation of floor slabs scheduled to receive floor coatings to conform with each different floor coating manufacturer’s requirements.

3.02 CONCRETE SLAB DRY OUT

A. General: Manage and control the variables affecting the slab dry out as required to maintain project schedule.

B. Concrete Floor Slab Dry Out: As soon as concrete slabs have fully cured and reached design strength, dry out concrete slabs using fans, heaters, and dehumidifiers until the concrete moisture content and moisture vapor emission rate are at levels required by coatings, adhesives and roofing/flooring manufacturers (confirm specific requirements for coatings, adhesives and roof/floor coverings scheduled to be installed).
   1. Where a liquid curing compound has been used to cure concrete slabs, remove any remaining compound from floor surface using rotary sander or other mechanical means as required to allow complete drying out of concrete slab and to allow for proper adhesive bond to concrete.
   2. Seal off exterior openings airtight as required to facilitate slab dry out.

3.03 EXAMINATION

A. Verify that slab surfaces are smooth and flat within tolerances specified in Section 03 30 01 and are ready to receive floor coating/covering or adhered roofing.

B. Verify that surfaces are dust-free, and free of substances which would impair bonding of adhesive materials to surfaces.

C. Verify that required floor-mounted utilities are in correct location and installed to proper height to receive flooring material flush with top surface.

3.04 PREPARATION

A. General: Prepare concrete slabs in conformance with ASTM F710 and the following.

B. Rough or Uneven Slabs: Remove any surface roughness, ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with cementitious underlayment to achieve smooth, flat, hard surface suitable for roof/floor covering installation. Slab surface shall be smooth and free of waviness, irregularities or unevenness of plane; prepare substrate and install underlayment in strict conformance to manufacturer’s installation instructions.
   1. Prohibit traffic until underlayment is cured.

C. Contaminated Concrete (oil, grease, wax, asphalt, etc.): Remove all contaminated concrete by mechanical means (shotblasting, grinding, scarabbling, jackhammer, etc.) and patch affected area with cementitious underlayment or new concrete slab as applicable condition. Do not use solvents or removers.
1. Patching does not apply to concrete slabs exposed to view with clear coating; remove these slabs to closest control or construction joints and repour concrete.

D. Concrete Slab Alkalinity: Where slab pH does not conform to coating, adhesive or roof/flooring manufacturer’s requirements the slab is not acceptable for installation of the specified coating/covering and will require corrective action (generally the pH level must be 9 or less, confirm specific requirements for each different coating, adhesive and roofing/floor covering specified). Take corrective measures to allow floor covering installation to proceed; any corrective measure must be approved by the coating, adhesive, or roofing/floor covering manufacturer.

E. Vacuum clean slab surfaces.

3.05 TESTING

A. Testing agency shall test concrete slab moisture vapor emission rate and pH level use the test procedures required by the coating, adhesive and roofing/floor covering manufacturer(s) and as described herein. Testing agency shall provide all test equipment and send copies of test results in report format to Contractor, Architect and Owner.

B. Concrete Slab Relative Humidity Test: Test the relative humidity of concrete slabs in accordance with ASTM F2170.
   1. Drill holes in slab and install plastic sleeves for inserting humidity probes at a minimum rate of 3 for first 1,000 square feet and 1 for every 1,000 square feet thereafter (e.g. 5,000 square feet of area would require 7 test points). Distribute test sites uniformly around space/area.
   2. Concrete slabs shall be at service temperature and air space above the floor slab shall be at service temperature and relative humidity for 48 hours prior to measuring concrete relative humidity.
   3. Allow 72 hours after installing plastic sleeves for slab to achieve moisture equilibrium within the hole before taking humidity measurements.
   4. Take relative humidity reading at each test location in accordance with the equipment manufacturer instructions to provide an accurate relative humidity reading of the slab.
   5. Record the relative humidity as a percentage.
   6. Number and record each test location on floor plan of the building.

C. Concrete Slab Moisture Emission Rate Test: Test slabs for moisture vapor emission rate in accordance with ASTM F1869.
   1. Maintain constant temperature of 70 degrees F in areas to be tested for 48 hours prior to test and for entire duration of test. Doors, windows and any openings to exterior shall be kept closed.
   2. Place Calcium Chloride Test dishes on floor slab in accordance with manufacturer’s instruction at the minimum rate of 3 test dishes for areas up to 1,000 square feet and 1 test dish for every 1,000 square feet thereafter (e.g. 5,000 square feet of floor covering area would require 7 test dishes). Distribute test dishes uniformly around space/area.
3. Tests sites shall be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, etc. 24 hours prior to the placement of test kits.

4. Weigh test dish on site prior to start of test. Scale must accurately report weights to 0.1 grams. Record weight of dish and start time.

5. Expose Calcium Chloride and set dish on concrete surface.

6. Install test containment dome and allow test to proceed for 60 – 72 hours.


8. Weigh test dish on site recording weight and stop time.

9. Calculate and record results as “pounds of moisture vapor emission per 1,000 square feet per 24 hours”.

10. Number and record each test location on floor plan of the building.

D. Concrete Slab pH Level Test:

1. At each vapor emission test site, after removal of test containment dome, perform pH test.
   a. Place several drops of distilled or de-ionized water onto dry concrete surface to form a puddle approximately 1” in diameter.
   b. Allow the water to set for approximately 60 seconds.
   c. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH level.

2. Record the results at each test site.

3.06 CONSTRUCTION & CONTROL JOINTS

A. Joint Layout And Sawcutting: Specified in Section 03 30 01.

B. Do not fill joints until concrete slab is fully cured and dried out so that normal shrinkage is complete.

C. Clean and prepare joint and bonding surfaces in accordance with manufacturer’s instructions, joint surfaces shall be thoroughly clean and dry.

D. Joint Filler Installation:

1. Filler At Floors Exposed To View: Fill joint with epoxy joint filler in accordance with manufacturer’s installation instructions.
   a. Protect exposed to view floor slab surfaces from staining by epoxy filler.
   b. Overfill joint slightly with epoxy filler.
   c. Cut off excess epoxy filler flush with top of slab using a sharp blade.

2. Filler At Floors With Floor Covering: Fill joint with either epoxy filler as described above or using cementitious underlayment.
   a. Cut off or grind top of joint filler flush with top of slab.
   b. Fill any voids or low areas so that joint is smooth, flush and free of irregularities in surface plane.
3.07 INSTALLATION – MOISTURE BARRIER

A. If the Contractor determines the need for installing a moisture barrier, either to maintain the project completion schedule, or as an alternative to replacement of a concrete slab that has too high a water vapor emission rate, conform to the following:

1. Select a moisture barrier manufacturer/product that will reduce the water vapor emission rate of the concrete slab to the level required by the coating/adhesive/roofing/floor covering manufacturer.

2. Prepare concrete and install moisture barrier in strict conformance with manufacturer’s installation instructions and as required to achieve specified warranty.
   a. Include any inspections by manufacturer’s technical representative or other special requirements required to achieve specified warranty.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Building Structural Steel

1.03 REFERENCES

A. All references shall be the latest adopted edition.


C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.

D. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society.

E. AWS D1.1 - Structural Welding Code - Steel; American Welding Society.

F. SSPC (PM2) - Steel Structures Painting Manual, Vol. 2 Systems and Specifications; Steel Structures Painting Council.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 Submittals, for submittal procedures.

B. Shop Drawings: Provide shop drawings prepared by a professional steel detailer.
   1. Show fabrication of structural steel components.
   2. Calculate and resolve all dimensions related to structural steel work and coordinate with work of other trades.
   3. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   4. Connections:
a. Indicate type, size, grade and length of bolts; distinguish between shop and field bolts. Clearly indicate pre-tensioned and slip critical high-strength bolted connections.

b. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

5. Indicate cambers and loads.
6. Include erection drawings, elevations, and details.
   a. Indicate all erection connections and accessories required.

C. Certification:
   1. Steel Materials: Provide certified mill test reports from manufacturer for all steel shapes supplied for project; in addition to the test data, the test reports shall identify test dates, project name, project location and name of steel fabricator along with steel member identification marks.
   2. Welding Materials: Provide manufacturer’s certificate of compliance for welding filler materials; certification shall include project name, project location and name of steel fabricator.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Fabricator shall be certified by the American Institute of Steel Construction (AISC), Category Standard, or the Fabricator shall have a minimum of (5) years experience in the fabrication of structural steel on similar size projects.

B. Fabricate structural steel members in accordance with AISC M016 and S303.
   1. Comply with Section 10 of AISC S303 for architecturally exposed structural steel.

C. Erector Qualifications: Company specializing in performing the work of this Section with minimum 5 years experience.

D. Welders: Qualified within the previous 12 months for type of welding required for this project in accordance with AWS D-1.1.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel Members: As specified in the Structural General Notes.

B. Structural Tubing: As specified in the Structural General Notes.

C. Bolts, Anchor bolts, Nuts, Washers, Shear Studs: As specified in the Structural General Notes.

D. Miscellaneous Structural Items and Accessories: As specified in the Structural
General Notes.

E. Non-Shrink Grout: As specified in the Structural General Notes.

F. Welding Materials: As specified in the Structural General Notes.

G. Shop and Touch-Up Primer: SSPC-Paint 15, Type 1, red oxide.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I Inorganic zinc rich.

2.02 FABRICATION

A. Coordinate and confirm field dimensions and conditions on site prior to shop fabrication.

B. Shop fabricate to greatest extent possible.

C. Fabricate structural steel members in accordance with AISC M016 and S303.
   1. Comply with Section 10 of AISC S303 for architecturally exposed structural steel where indicated on the drawings.
   2. Camber steel members as indicated on the drawings. Fabricate all beams with rolling camber up.

D. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

E. Fabricate connections for bolt, nut, and washer connectors.

F. Welding shall conform to Structural Welding Code AWS D-1.1.

2.03 SHOP PRIME FINISH

A. Exterior Structural Steel: Surface preparation and shop priming shall be accomplished in dry, temperature controlled environment conforming to primer manufacturer’s application requirements.
   1. Prepare surfaces to be finished in accordance with SSPC-SP 6, Commercial Blast Cleaning.
   2. Shop prime surfaces with primer immediately after surface preparation is completed.

2.04 SOURCE QUALITY CONTROL

A. Engage an independent testing and inspection agency to perform shop inspections and test and prepare test reports as noted on the Inspection Schedule on the Structural Drawings and in accordance with Section 01 45 00.

B. Provide testing agency with access to places where structural steel work is being
C. fabricated to allow required inspections and testing.
D. Correct deficiencies or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
E. Non-conforming work shall be reinspected and tested for compliance.
F. Inspection and testing agency shall confirm current qualifications of each shop welder working on this project.

PART 3 - EXECUTION

3.01 COORDINATION
A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

3.02 EXAMINATION
A. Verify that dimensions and conditions are appropriate for erection of structural steel and that the work may properly proceed.
B. Beginning installation indicates erector's acceptance of dimensions and conditions.

3.03 PREPARATION
A. Provide temporary shores, guys, braces and other supports during erection to keep structural steel secure, plumb and in alignment against temporary construction loads and loads equal in intensity to design loads.
B. Remove temporary supports only after all permanent structural members, braces, shear walls, diaphragms and brace frames are in place and properly connected.

3.04 ERECTION
A. Erect structural steel accurately in locations and to elevations required in compliance with AISC S303.
B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
C. Field weld components as indicated on Drawings in conformance with AWS D1.1.
D. Install and tighten bolted connections as indicated on Drawings.
E. Do not field cut or alter structural members without approval of Architect.
F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete or fireproofing.
G. Grout solidly between bearing plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.05 ERECTION TOLERANCES

A. Maintain erection tolerances of structural steel with in AISC S303 and the following.
   1. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

3.06 FIELD QUALITY CONTROL

A. Engage an independent testing agency to perform field quality control inspection and testing for the work of this section as noted on the Inspection Schedule on the Structural Drawings and as specified in Section 01 45 00.
B. Provide testing agency with safe access to work at project site and accommodate their requirements.
C. Welder Qualifications: Testing agency shall confirm current qualifications of each field welder working on this project.

3.07 PROTECTION

A. Surfaces Exposed To View: Protect primed surfaces of structural steel exposed to view from damage during shipping, handling and erection.

END OF SECTION
SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions, Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Miscellaneous metal fabrications including handrails, brackets, and other items as noted on the Drawings.

1.03 REFERENCES

A. All references shall be the latest adopted edition.


J. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
K. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

L. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society.

M. AWS D1.1 - Structural Welding Code - Steel; American Welding Society.

N. SSPC (PM2) - Painting Manual, Vol. 2, Systems and Specifications; Steel Structures Painting Council.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Shop Drawings: Submit shop drawings prepared by a professional steel detailer showing each metal fabrication; indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.05 QUALITY ASSURANCE

A. Welders: Qualified within the previous 12 months for type of welding required for this project in accordance with AWS D-1.1 and AWS D 1.4.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Sheet: ASTM A1008.

B. Solid Steel Bars, Plates & Shapes: ASTM A36.

C. Steel Tubing: ASTM A500, Grade B.

D. Plates: ASTM A283.

E. Pipe: ASTM A53, Grade B Schedule 40, black finish.

F. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized components.

G. Welding Materials: AWS D1.1; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, Type 1, red oxide.
I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I Inorganic zinc rich.

2.02 FABRICATION

A. Coordinate and confirm field dimensions and conditions prior to fabrication.

B. Fit and shop assemble items in largest practical sections, for delivery to site.

C. Fabricate items with joints tightly fitted and secured.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Pipe Bollards: Schedule 40 steel pipe, size as shown on Drawings, hot-dipped galvanized after fabrication.
   1. Finish: Field painted by Section 09 90 00.

B. Half-High Wall Supports: Welded steel construction, fabricate as shown on Drawings and as required to fit within wall framing.
   1. Finish: Shop prime paint.

C. Miscellaneous Framing and Supports: Fabricate from structural steel shapes, plates, and bars, of welded construction to sizes, shapes, and profiles indicated and required, to receive other adjacent construction retained by framing and supports.
   1. Use mitered joints for field connection.
   2. Cut, drill, and tap units to receive hangers, hardware, and similar items.
   3. Hot-dip galvanize items on building exterior, exposed to exterior atmosphere or so indicated on the Drawings; prime paint other items.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and joists; prime paint finish.
   1. Hot-dip galvanize after fabrication.

E. Other Miscellaneous Fabricated Steel Items Shown On The Drawings: Fabricate
2.04 FINISHES - STEEL

A. Prime Paint:
1. Prepare surfaces to be primed in accordance with SSPC-SP-1 and SP 3.
2. Clean surfaces of rust, scale, oil, grease, and foreign matter prior to finishing.
4. Steel With Fireproofing: Do not shop prime, leave steel surfaces bare.

B. Galvanizing: Galvanize after fabrication to ASTM A123. Provide minimum 2.0 oz/sq ft galvanized coating.
1. Hot-dip galvanize fabricated items located on building exterior, exposed to exterior atmosphere or so indicated on the Drawings.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: No misalignment allowed, fabricate flush.
C. Maximum Misalignment of Adjacent Members: 1/16 inch.
D. Maximum Bow: 1/8 inch in 48 inches.
E. Maximum Deviation From Plane: 1/16 inch in 48 inches, non-cumulative.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

3.02 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.
B. Beginning installation indicates installer's acceptance of conditions.

3.03 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply setting templates to the appropriate entities for steel items required to be
cast into concrete or embedded in masonry.

3.04 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on shop drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized.

G. Touch up damaged areas of galvanized finish on fabrications with touch up primer.

3.05 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.


END OF SECTION
SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES
A. Rough Carpentry

1.03 REFERENCES
A. All reference shall be the latest adopted edition, or as noted.
B. AWPA C2 - Lumber, Timbers, Bridge Ties and Mine Ties--Preservative Treatment by Pressure Processes; American Wood-Preservers' Association
C. AWPA C20 - Structural Lumber--Fire Retardant Treatment by Pressure Processes; American Wood-Preservers' Association
E. IBC – International Building Code
F. ICC – International Code Council
G. WCLB (GR) - Standard Grading and Dressing Rules No. 17; West Coast Lumber Inspection Bureau
H. WWPA G-5 - Western Lumber Grading Rules; Western Wood Products Association

1.04 SUBMITTALS
A. Refer to Section 01 33 00 for submittal procedures.
B. Product Data: Provide product data on the following items:
   1. Sill Gasket
   2. Metal screen

1.05 QUALITY ASSURANCE
1.06 DELIVERY, STORAGE & HANDLING
A. Cover wood products to protect against moisture and growth of mold/mildew. Support stacked products to prevent deformation and to allow air circulation.

PART 2 - PRODUCTS

2.01 DIMENSION LUMBER
A. Species: As specified in the General Notes on the Structural Drawings.
B. Grade: As specified in the General Notes on the Structural Drawings.
C. Sizes: Nominal sizes as indicated on drawings, S4S.
D. Moisture Content: Maximum 19 percent, stack or kiln-dried.
E. Backing: 2 x 6 and larger solid lumber, cut from No. 2 Douglas Fir/Larch dimension lumber that is free of large knots, splits or other defects that would reduce the strength of the backing piece.

2.02 TIMBERS
A. Species: As specified in the General Notes on the Structural Drawings.
B. Grade: As specified in the General Notes on the Structural Drawings.
C. Sizes: Nominal sizes as indicated on drawings, S4S.
D. Moisture Content: Maximum 19 percent, stack-dried.

2.03 ENGINEERED WOOD

2.04 CONSTRUCTION PANELS
A. APA Rated Roof Sheathing: As specified in the General Notes on the Structural Drawings.
B. Roofing Nailer/Sheathing: APA Rated Sheathing 5/8" thick, tongue and groove edges, C-DX Grade with exterior plys.
C. APA Rated Wall Sheathing: As specified in the General Notes on the Structural Drawings.

D. Miscellaneous Panels:
   1. Electrical /Phone Component Mounting: 3/4” thick APA Rated Fir plywood, sanded face, B-C, exterior grade, PS 1, fire retardant treated.

2.05 ACCESSORIES

A. Fasteners, Anchors and Anchorbolts: As specified in the General Notes on the Structural Drawings for structural applications.
   1. Fasteners on Building Exterior, in High Humidity or in Preservative Pressure Treated Wood: Stainless steel or hot-dipped galvanized.
      a. Use only stainless steel fasteners in wood treated with ACZA preservative treatment.
   2. Anchor For Concrete and Masonry: As specified in the General Notes on the Structural Drawings for structural applications and the following:
      a. Concealed Location: Zinc plated steel, expansion type fasteners manufactured by Rawl or Hilti.
      b. Exposed Location: Hot-dipped galvanized or stainless steel.
      c. Preservative Pressure Treated Wood: Hot-dipped galvanized or stainless steel.
         1) Use only stainless steel anchors in wood treated with ACZA preservative treatment.

B. Die-Stamped Framing Connectors: As specified on the Structural Drawings; hot dipped galvanized steel, ICC approved, Simpson StrongTie or similar.
   a. Connectors Exposed To Weather: Hot dip galvanize after fabrication.

C. Joist Hangers: As specified on the Structural Drawings; hot dipped galvanized steel, ICC approved, sized to suit framing conditions and loads, Simpson StrongTie or similar.

D. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, match width of sill plate, ribbed closed cell plastic foam from continuous rolls; Owens Corning FoamSealR or similar.

E. Construction Adhesive: APA AFG-01, Waterproof, solvent base, air cure type, cartridge dispensed.

F. Weather Resistive Barrier (WRB): Specified in Section 07 27 00.

G. Building Paper: 30 lb. asphalt saturated felt.

2.06 FACTORY WOOD TREATMENT

A. Preservative Pressure Treatment of Lumber Above Grade: AWPA Treatment C2 using waterborne preservative to 0.25 percent retention.
   1. Klin dry after treatment to maximum moisture content of 19 percent.
2. Do not incise wood exposed to view in the finish construction.
3. Treat wood in contact with roofing, flashing, or waterproofing.
4. Treat wood in contact with masonry or concrete.

B. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA Treatment C2 using waterborne preservative designated in AWPA C2 as suitable for ground contact to 0.40 percent retention.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate the layout of wall, floor, ceiling and roof framing to accommodate the location of mechanical and electrical penetrations and recessed items and to minimize cutting framing members and/or framing openings in these assemblies.

C. Coordinate the layout and location of wall framing and solid 2x wood backing for attachment of finish wood fabrications with Section 06 20 00.

D. Coordinate the installation of the plywood roof sheathing with dry weather and cover immediately, do not allow to get wet.

E. Coordinate the layout and location of wall framing and solid 2x wood backing for attachment of fiber cement siding with Section 07 46 49.

F. Coordinate the layout and location of wall framing and solid 2x wood backing required for attachment and support of Contractor and Owner furnished toilet and miscellaneous accessories shown on the Drawings and specified in Section 10 28 00.

G. Coordinate the layout and location of wall framing and solid 2x wood backing to accommodate layout of cabinets shown on the Drawings and specified in Section 12 32 00.

H. Coordinate the layout and location of wall framing and solid 2x wood backing required for attachment and support of surface-mounted plumbing items specified in Division 22.

I. Coordinate the layout and location of wall framing and solid 2x wood backing required for attachment and support of surface-mounted electrical items specified in Division 26 through 28.

J. Coordinate the layout and location of wall framing and solid 2x wood backing required for attachment and support of surface-mounted Owner Furnished Owner
3.02 GENERAL

A. Drilling, Notching & Cutting: Coordinate and control drilling, notching and cutting of all framing members required to admit or install work of other trades, do not violate the structural integrity of any wood framed members, comply with restrictions and requirements of Structural Engineer, IBC and local Building Official.

B. Nailing: Nailing shall conform to the size and spacing shown on the Structural Drawings; where nailing is not indicated, provide nailing per IBC Table 2304.9.1. Fastener Schedule.

C. Wood In Contact With Concrete & Masonry shall be preservative pressure treated.
   1. At ends of beams, behind engineered wood ledgers or at similar situations, separate wood from concrete or masonry with building paper.

3.03 FRAMING INSTALLATION

A. Cut and fit framing members accurately, set members level, plumb, and true to line. Discard crooked or twisted pieces or with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Wall Plates: Comply with size(s) shown on Structural Drawings.
   1. Bottom plates bearing on concrete shall be preservative pressure treated.
   2. Bore holes of proper diameter for anchor bolts accurately; oversized or elongated holes are not acceptable.
   3. Install continuous sill gasket under bottom plates of exterior walls.

C. Wall Framing: Cull out crooked, twisted or inconsistent width framing, align framing members so that finish walls are straight and free of waviness.

D. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

E. Install structural members full length without splices.

F. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated on Drawings and Structural General Notes, but not less than required by applicable codes.

G. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

H. Provide framing members at all vertical ends/edges of GWB and wall sheathing and at ends of floor sheathing.
I. Construct headers at floor, roof and wall openings required by the design and work of other trades. Where not shown, provide double joist headers; use metal joist hangers unless otherwise detailed.

J. Provide mid-span bridging at joists as shown on the Drawings and at all spans in excess of 8 feet. Fit solid blocking at ends of members and at bearing points.

K. Frame wall openings required by the design and for work of other trades. Where not shown, provide a minimum two or more studs at each jamb; support headers on cripple studs; coordinate with requirements of Structural Drawings.

L. Provide blocking between framing members wherever required by Drawings, IBC, Building Official, or good construction practice.

M. Fire Stops: Install solid 2x lumber blocking fire stops (or other approved material) in accordance with the requirements of the UBC and the Building Official including, but not limited to the following locations:

1. In concealed spaces of stud walls and partitions, including furred spaces, at the ceiling and floor levels and at 10-foot intervals both horizontal and vertical.
2. At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and suspended lay-in ceilings.
3. Concealed spaces behind combustible trim and finish: Fire stop at intervals not exceeding 10 feet.
4. Concealed spaces behind exterior cornices or other elements: Fire stop at intervals not exceeding 20 feet.
5. In wall framing in line with stair stringers and between stair stringers and wall.

N. Provide additional framing members and/or modifications required to accommodate work of other trades.

O. Provide backing and miscellaneous members as indicated or as required to support work provided by other trades (finishes, fixtures, specialty items, trim, etc.).

3.04 INSTALLATION - WOOD BACKING

A. Provide backing and miscellaneous 2x framing members as indicated or as required to support work provided by other trades (finishes, fixtures, specialty items, trim, etc.).

B. Fiber Cement Siding & Trim: Provide solid 2x wood backing for fiber cement siding and trim attachment points that do not occur on framing members to facilitate secure attachment of siding.
C. Door Hardware:
   1. Provide 2x6 wood backing for door wall stops.

D. Toilet Accessories: Provide solid 2x wood backing for attachment of toilet accessories. Backing for grab bars shall be installed to support 300 pound sustained load on each backing piece without deflection or failure.
   1. Provide backing for Owner Furnished accessories.

E. Casework: Provide solid 2x wood backing for attachment/support of casework.

3.05 INSTALLATION OF ACCESSORIES & MISCELLANEOUS WOOD

A. Install sill gasket directly on concrete foundation under exterior wall plates. Puncture gasket cleanly and fit tightly to protruding foundation anchor bolts.

B. Coordinate installation of glue laminated structural units, prefabricated wood trusses, and plywood web joists.

C. Construct curbs at roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

D. Backing for Owner Installed Items: Provide backing for Owner installed items indicated on Drawings.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels perpendicular to framing members, with ends staggered and sheet ends over firm bearing.
   1. Install roof sheathing in dry weather and cover with temporary or permanent roofing immediately to avoid panels getting wet.
   2. Use only full sized panels, cut to fit; do not use cutoff ends pieced together where a full size panel will fit.
   3. Edge/End Gap: Install sheathing panels with gap between sheets as recommended by APA.
   4. Provide solid edge blocking between sheets where shown on Drawings.
   5. Nail panels to framing at spacing indicated on Structural Drawings.

B. Roofing Nailer/Sheathing: Coordinate with installation of rigid foam roof insulation and asphalt shingles to prevent insulation and sheathing from being exposed to the weather or to get wet.
   1. Install roofing nailer/sheathing in dry weather and cover with temporary or permanent roofing immediately to avoid panels getting wet.
   2. Secure panels perpendicular to framing members, with ends staggered and sheet ends over firm bearing.
   3. Use only full sized panels, cut to fit; do not use cutoff ends pieced together where a full size panel will fit.
   4. Edge/End Gap: Install sheathing panels with gap between sheets as recommended by APA.
   5. Nail panels to furring at 8” on center spacing or as indicated on Drawings.
6. Provide ventilation holes through roofing nailer/sheathing as required for free flow of ventilation air between rigid foam insulation and sheathing.

C. Wall Sheathing: Orient sheathing panels with long dimension perpendicular to wall studs and ends over firm bearing, stagger end joints between adjacent panels, securely nail as noted on Structural Drawings or, where not noted, per code.
   1. Use only full sized panels, cut to fit; do not use cutoff ends pieced together where a full size panel will fit.
   2. Edge/End Gap: Install sheathing panels with gap between sheets as recommended by APA.

3.07 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.08 DRILLING, CUTTING & NOTCHING

A. Do not drill, cut, notch or alter any structural framing, except as noted on the Drawings and in this specification, without the approval of the Structural Engineer.

3.09 WORKMANSHIP

A. Carpentry work shall be accomplished using the best workmanship, including the following:
   1. Crooked, bowed, twisted or damaged lumber culled out and used for blocking/backing.
   2. End cuts at proper angle and length for tight fit.
   3. Nailed connections free of splitting or damage.
   4. Framing aligned plumb and square.
   5. Framing conforming to specified tolerances.
   6. Bolt/anchor holes not oversized or misaligned.
   7. Panel ends aligned at center of supporting framing member.
   8. Panel ends and edges properly gapped.
   9. Consistent nail spacing on panels.

B. Any part of the carpentry work installed with improper or poor workmanship shall be removed and replaced at Contractor’s expense.

3.10 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum, provided other tolerances are met.

B. Wall & Roof Plane (Flatness): Maximum of ¼” in 10’-0” out of plane (this equates
to no more than 1/8" gap at each end of a 10'-0" long straightedge center on high spot in wall, or no more than 1/8" gap at center of a 10'-0" long straightedge centered on low spot in wall).

END OF SECTION
SECTION 06 17 33
SOLID WEB WOOD JOISTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General Conditions, Supplementary General Conditions and Division 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Solid web wood joists

1.03 REFERENCES

A. All reference shall be the latest adopted edition, except as noted.

B. WCLB (GR) - Standard Grading and Dressing Rules No. 17; West Coast Lumber Inspection Bureau.

C. WWPA G-5 - Western Lumber Grading Rules; Western Wood Products Association.


1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Provide manufacturer’s product literature showing joist configurations, bearing and anchor details, bridging and bracing.

C. Shop Drawings: Provide plan view layout of all joists; indicate sizes and spacing of joists, loads and joist cambers, framed openings.
   1. Shop Drawings shall be stamped by Structural Engineer licensed as such in the State of Washington.

D. Deferred Submittal To Building Official: Submit shop drawings and structural calculations to the Building Official for review and approval as a deferred submittal; make any corrections and provide any additional information required.
to obtain approval by Building Official.
1. Approved Fabricator: Provide documentation of manufacturer’s approved fabricator status conforming to Chapter 17 of the International Building Code as required by Building Official for approval.
2. Certificate of Compliance: At completion of fabrication, submit a certificate of compliance to the Building Official stating that the work was performed in accordance with the approved construction documents (per Section 1704 of the International Building Code).

1.05 QUALITY ASSURANCE

A. Joists shall be designed and manufactured to the standards set forth in a current, approved ICC ES Report (International Code Council Evaluation Service) for the joists.

B. Joists shall be manufactured in a plant approved for fabrication by the building code and under the supervision of an approved third party inspection agency.

C. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

D. Design joists under direct supervision of a Professional Structural Engineer experienced in design of products of this type and licensed as such in the State of Washington.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for loads, seismic zoning, other governing load criteria.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle joists in conformance with manufacturer’s instructions.

B. Protect joists from warping or other distortion by stacking in vertical position, braced to resist movement.

C. Cover joists to prevent them from weather and moisture, store up off ground.

1.08 FIELD MEASUREMENTS

A. Verify that shop drawing dimensions match actual field measurements.
PART 2 - PRODUCTS

2.01 SOLID WEB WOOD JOISTS

A. Joist Design: Fabricator is responsible for the structural engineering design for joists and any connections not shown on the Drawings.
   1. Engage the services of a qualified professional Structural Engineer, experienced in design of solid web wood joists and currently registered in the State of Washington, to provide the structural engineering design.
   2. Design joists in conformance the following:
      a. Design solid web wood joists to withstand design loads and with deflection factor(s) in conformance with the requirements shown on the Structural Drawings.
      b. Design Criteria listed in the General Notes on the Structural Drawings.
   3. Work Of Other Trades: Review and coordinate work of other trades that interface with, connect to, pass through or are supported by the solid web wood joists.
      a. Make whatever provisions are necessary to the design, layout and fabrication of the solid web wood joists to accommodate work by others while maintaining their specified structural capacity.
      b. Design solid web wood joists to allow for support, connection and installation of mechanical ducts, pipes or other large items supported by joists.

B. Manufacturers: The following manufacturers may provide solid web wood joists subject to their ability to conform to the requirements of the Drawings and this Section:
   1. Boise Building Solutions Manufacturing LLC
   2. Roseburg Forest Products Company
   3. Trus Joist, A Weyerhaeuser Business
   4. Redbuilt Engineered Wood Products
   5. Substitutions: Refer to Section 01 60 00 for substitution procedures.

2.02 MATERIALS

A. Joist Materials: Flange members, web members, adhesives and connectors shall conform to the provisions of a current, approved ICC ES Report.

B. Joist Bridging: Type, size and spacing recommended by joist manufacturer.

2.03 ACCESSORIES

A. Wood Blocking and Framing for Openings: As shown on Structural Drawings
and required by joist design.

B. Roof Overhang Outlookers: Provide solid 2x wood outlookers for roof overhangs where noted on Drawings or wherever overhangs are exposed to view.

C. Vent Blocking: Drill vent holes in manufacturer's standard blocking material and attach galvanized wire screen securely over vent openings to prevent entrance of insects and animals.

D. Fasteners: Hot dip galvanized steel, type to suit application.

2.04 FABRICATION

A. Verify dimensions and site conditions prior to fabrication.

B. Fabricate joists to achieve the architectural and structural requirements shown on the Drawings and specified herein and in accordance with approved shop drawings and the current ICC ES Report.

C. Ventilation Holes: Provide holes in web to allow code required ventilation above joists with batt insulation installed in joist space. Coordinate location of holes in web with location of top of insulation to allow unrestricted ventilation above insulation and below roof deck. Coordinate which joists require vent holes, do not punch any openings in webs of trusses which are required to remain solid for code required draft stop.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate installation with carpentry work and glue-laminated beam installation specified in Section 06 10 00 and 06 18 00.

3.02 EXAMINATION

A. Verify bearing conditions installed by other Sections are acceptable for solid web wood joists installation in accordance with manufacturer's instructions.

B. Do not proceed with installation until unacceptable conditions are corrected.

C. Start of installation indicates acceptance of bearing and site conditions.
3.03 PREPARATION

A. Coordinate placement of support items.

3.04 ERECTION

A. Install joists and bridging in strict accordance with approved shop drawings and manufacturer's installation instructions.

B. Set structural members level (as appropriate) and plumb, in correct position.

C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

D. Install blocking, chord stiffeners or anything else required by manufacturer wherever other work or framing is supported from joists.

E. Install permanent bridging and bracing.

F. Frame openings and install chord stiffeners, headers, blocking, hangars, supports and other items recommended by manufacturer as required to accommodate the work of other trades.

G. Vent Blocking: Install vent blocking in joist framing with batt insulation under the roof deck to allow code required ventilation above the insulation. Coordinate placement and layout of vent holes to permit unrestricted flow of ventilation air from roof eave to roof peak in each roof truss space.

H. Place headers and supports to frame openings required.

I. Frame openings between joists with lumber in accordance with Section 06 10 00 and as shown on the Drawings.

J. Coordinate placement of sheathing with work of this section.

3.05 DRILLING, CUTTING AND NOTCHING

A. Do not drill, cut, notch or alter joists without the written approval of the joist manufacturer and stamped by their Structural Engineer.

END OF SECTION
SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

B. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 REFERENCES

A. American Plywood Association (APA).

B. Architectural Woodwork Institute (AWI).


1. PS-1 - "Construction and Industrial Plywood."

1.03 SUBMITTALS

A. Shop Drawings: Show materials, methods of fabrication, and details of installation.

B. Samples: Furnish required samples with finishes specified.

1.04 QUALITY ASSURANCE

A. Qualifications: Provide finish carpentry Work in accordance with AWI "Quality Standards," in the grades specified.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cedar Trim and Soffit Materials:

1. Exterior Trim: Solid stock red cedar, S4S, tightknot for semi-transparent or paint finish. Sizes as shown on the drawings.

2. Exterior Soffits: Solid stock tightknot red cedar, S4S, for semi-transparent finish and Solid stock red cedar, S4S, tightknot for semi-transparent finish. Sizes as shown on the drawings.

B. Telephone Terminal Board: Douglas fir BC Grade interior plywood, 3/4 inch thick, size as shown.

C. Shelving: Douglas fir BB Grade interior plywood, 3/4 inch thick up to 3'-6” length, 1-1/8 inch thick up to 6 feet length, with edge band at all exposed edges.

D. Fasteners:
   1. As shown, specified, and as required to securely install materials.
   2. Fasteners for Exterior Use: Aluminum.
   3. Size of fasteners for siding and paneling shall be as recommended by manufacturer.

E. Joint Sealant: As specified in Section 07 90 00.

F. Closet Shelving and Clothes Rods:
   1. Conform with Drawings and meet Custom Grade requirements of AWI Section 600.
   2. Clothes Rods: 1-3/8 inch diameter wood poles, or seamless chrome-plated brass pipe, or extruded aluminum pipe, minimum 1-1/4 inch nominal diameter, furnished complete with matching flanges and fastenings. Include mid-span wall-bracket support for spans exceeding 4 feet.

2.02 FABRICATION

A. Conform with AWI "Quality Standards," Section 300, Custom Grade requirements as applicable. Standard wood moldings shall conform with Western Wood Product Association WP Series, where applicable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all millwork in accordance with reviewed shop drawings and AWI "Quality Standards."

B. Cope internal corners and miter external corners at all standing and running trim.

C. Provide running trim in as long lengths as practical. Make splices with 45 degree butt joints.

D. Install materials straight and true. Leave 1/8 inch space between ends of exterior trim, seal joint. Tightly butt ends of interior trim.

E. In exterior Work drive nail heads flush with surface of trim. Maintain nailing pattern in straight horizontal lines.
F. In interior Work countersink nails and fill nail holes.

G. Machine sand trim and finish with hand sanding. Leave free from machine or tool marks that will show through finishes specified. Ease all edges of trim.

H. Install all finish hardware, accurately fit, securely apply, and carefully adjust to provide smooth and proper operation of all hardware.

I. Miscellaneous Items: Install all items shown and specified, which are not called for to be installed under other Sections, to plumb, true, and level lines and positions. Install in accordance with details, manufacturer's printed instructions and additional requirements specified. Provide connections and miscellaneous items required to make Work of this Section complete. Securely fasten wall and ceiling mounted items to solid backing or blocking.

3.02 CLEANING

A. Remove dirt and other foreign matter from installed materials.

B. Upon completion of installation, leave materials clean and ready for finishing.

END OF SECTION
SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions, Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Thermal Batt Insulation
B. Sound Batt Insulation
C. Foundation Perimeter Rigid Foam Insulation
D. Vapor Retarder

1.03 REFERENCES

A. All references shall be the latest adopted edition.
E. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.
B. Product Data: Submit manufacturer’s data sheet for each product specified.
1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

B. Do not install interior building insulation until after roof is on, building is dried in and building interior is thoroughly dried out.

PART 2 - PRODUCTS

2.01 BATT INSULATION MATERIALS

A. Thermal Insulation: Unfaced with out membrane facing, Mineral fiber type manufactured from glass, ASTM C 665, Type I, max flame spread 25 – 50, glass fiber rolls and batts. Width to fit stud, truss or joist spacing.

B. Thermal Insulation: Faced mineral fiber blanket/batts, ASTM C 665, Type III, Class A, Blankets with reflective vapor retarder membrane facing, foil scrim kraft vapor retarder, maximum flame spread 25 or less. Width to fit stud, truss or joist space.

C. Sound Attenuation Blanket Insulation: ASTM C 665, Type I blankets without membrane facing. maximum flame spread 25 or less. Width to fit stud, truss or joist space. R-Value R-11.

2.02 BOARD INSULATION MATERIALS

A. Rigid Foam Foundation Perimeter Insulation: Rigid Foam Perimeter Extruded Polystyrene Board Insulation, ASTM C578, Type IV; extruded cellular type polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
   2. Compressive Resistance: 20 psi
   3. Water Absorption, maximum: 0.3 percent, volume.
   5. Thermal Value Test Standard: Stabilized R-values @ 75°F mean temperature determined in accordance with ASTM C518.
   6. Total R-Value: As indicated on Drawings.

2.03 ACCESSORIES

A. Vapor Retarder (covered condition): 4 mil virgin polyethylene film, clear, no recycled film allowed.

B. Tape For Vapor Retarder Joints: Polyethylene self-adhering type, 2 inches wide.
PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Schedule installation of batt insulation to occur after building is fully enclosed and materials dried out; coordinate with Building Acclimatization And Dry Out specified in Section 01 50 00.

3.02 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are completely dry and that substrates are ready to receive insulation.
   1. Do not start installation of any insulation until building structure and interior is dried out and that moisture condensation within the insulation or on interior side of exterior sheathing does not occur.
   2. Perform moisture testing on building structure/materials to confirm moisture content.

B. Start of insulation installation indicates approval of substrate and site conditions, including dry out of building structure and materials.
   1. Moisture condensation problems that occur within insulated spaces are the responsibility of this Section to correct, including replacement of materials damaged by water or mold.

3.03 INSTALLATION - THERMAL BATT INSULATION

A. Install insulation in accordance with manufacturer's instructions. Friction fit in cavities and spaces to prevent displacement or sagging.

B. Insulate the entire perimeter of the building exterior without gaps or voids. Do not compress insulation.

C. Where wall framing is deeper than the insulation, place the batt tight to the exterior wall sheathing (leaving a void space on the interior, warm side of the batt).

D. Trim insulation neatly to fit spaces. Insulate miscellaneous cavities, gaps and voids.

E. Fit insulation to the exterior side of mechanical and electrical services within the plane of the insulation. Leave no gaps or voids.
   1. Where mechanical piping will not allow installation of insulation to the exterior side and prevent freezing, report condition to Division 22 installer for correction before insulating or closing up the space.
3.04 INSTALLATION - VAPORETARDER AT THERMAL BATT INSULATION

A. Install vapor retarder membrane in a continuous unbroken sheet over warm side of thermal batt insulation in exterior walls.
   1. Installation of vapor retarder shall follow immediately after installation of insulation.

B. Lap ends and side flanges of membrane over framing members and seal with continuous tape.

C. Run vapor retarder over electrical outlet boxes and other openings in wall and cut out after installation for airtight fit.

D. Tape seal tears or cuts in vapor retarder for continuous unbroken vapor retarder.

E. Extend vapor retarder into window, door and other openings in exterior walls; overlap and seal airtight to exterior flexible flashing. Tape seal in place.

3.05 INSTALLATION - SOUND INSULATION

A. Install insulation in accordance with manufacturer's instructions. Friction fit in cavities and spaces to prevent displacement or sagging.

B. Insulate the entire width/height of the wall/floor assembly without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous cavities, gaps and voids.

D. Coordinate and monitor installation during GWB installation so as to prevent displacement or removal of batts.

3.06 INSTALLATION – FOUNDATION PERIMETER RIGID FOAM INSULATION

A. Install rigid insulation at locations shown on Drawings, with the minimum number of joints possible and joints fitted tight free of cracks and voids.

B. Cut insulation tight to adjacent surfaces and to utilities penetrating insulation.

3.07 PROTECTION OF FINISHED WORK

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION
SECTION 07 26 00

VAPOR RETARDERS

PART 1 - GENERAL

1.1 REFERENCES


PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Retarder (covered condition): 4 mil virgin polyethylene film, clear, no recycled film allowed.

B. Tape For Vapor Retarder Joints: Polyethylene self-adhering type, 2 inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install vapor retarder on interior face of all exterior walls per manufacturer's recommendations.

B. Tape and seal all joints tight for air leakage.

END OF SECTION
SECTION 07 27 00
WEATHER RESISTIVE BARRIERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Weather Resistive Barrier (WRB)

1.03 REFERENCES

A. All references shall be latest adopted edition.
B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants
C. ASTM C1193 - Standard Guide for Use of Joint Sealants
D. ASTM D882 - Test Method for Tensile Properties of Thin Plastic Sheeting
F. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials
G. ASTM E96 - Test Method for Water Vapor Transmission of Materials
H. ASTM E1677 - Specification for Air Retarder Material or System for Framed Building Walls
I. ASTM E2178 - Test Method for Air Permeance of Building Materials
J. AATCC – American Association of Textile Chemists and Colorists Test Method 127 Water Resistance: Hydrostatic Pressure Test
K. DuPont Tyvek Installation Guidelines – Dupont Tyvek Weather Barrier Commercial Installation Guidelines
M. TAPPI Test Method T-410; Grams of Paper and Paperboard (Weight per Unit
1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Submit product data for each component of the weather resistive barrier system.

C. Quality Assurance Submittals: Provide manufacturer test reports indicating product compliance with indicated requirements.

D. Manufacturer’s Field Service Reports: Provide site reports from manufacturer’s authorized field service representative, indicating observation of weather barrier assembly installation.

E. Warranty Authorization: Submit evidence from manufacturer that project is approved for warranty coverage.

F. Closeout Submittal: Submit manufacturer’s executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.05 DEFINITIONS

A. Weather Resistive Barrier System (System): A vapor permeable secondary barrier installed behind the primary exterior cladding/siding installation that provides a liquid water and air barrier preventing the passage of liquid water to the interior side of the weather resistive barrier system at any point in the system, including penetrations and interfaces between different materials, and reduces air leakage to a defined level.

B. Weathertight: Weatherproof; able to withstand exposure to weather without damage, loss of function or leakage.

1.06 QUALITY ASSURANCE

A. Installer: Installer shall have a minimum of 5 years experience with the installation of weather resistive barrier systems and have a thorough understanding of the theory and practical application of secondary weather resistive barrier systems in exterior cladding/siding applications.

B. Installation: Installation shall be in accordance with System manufacturer’s installation guidelines and recommendations.

C. Source Limitations: Weather Resistive Barrier System components shall be produced or approved in writing by single manufacturer.
1.07 MOCK-UPS

A. Mock-Up – General: Construct mock-ups of each different condition found within the exterior wall assembly. Mock-up may be part of the final construction if workmanship and assembly conform to the requirements of the Contract Documents.

B. Mock-Ups required for each of the following exterior wall conditions:
   1. Window Openings
   2. Door Openings
   3. Duct/Louver Openings
   4. Lights
   5. Structural members penetrating exterior walls

C. Each different mock-up shall demonstrate the proper installation sequence and workmanship required for the weather resistive barrier system installation at all openings and penetrations through the exterior wall assembly to provide a watertight seal to windows, doors, ducts, lights, structural members, etc.

D. Notify manufacturer’s field service representative, Architect and Owner Representative when mock ups are complete.

E. Correct any non-conforming work; mock-ups conforming to requirements of Contract Documents shall become the standard of quality and construction for all subsequent similar conditions.

F. Mock-ups may be left in place as part of the completed work if they are properly installed.

G. Do not start installation of weather resistive barrier system until a mock-up has been constructed and approved by the manufacturer’s field service representative and the Architect/Owner. Do not install any doors, windows or masonry until mockup is approved. If Contractor installs masonry, doors or windows prior to approval of all window and door opening flashing said such work shall be removed no exceptions.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Deliver weather resistive barrier materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store weather resistive barrier system materials as recommended by weather barrier manufacturer.

1.09 PRE-INSTALLATION CONFERENCE

A. 2 weeks prior to start of installation schedule a pre-installation conference at the job site to review the project conditions and installation requirements. Persons
attending pre-installation conference shall include the General Contractor, Installer, Architect, Owner Representative(s) and System manufacturer’s designated field service representative.

B. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer’s training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.10 SCHEDULING

A. Review requirements for sequencing of installation of weather resistive barrier system with installation of windows, doors, louvers, lights and flashings to provide a weather-tight barrier assembly.

1.11 WARRANTY

A. Provide special System manufacturer’s warranty for weather resistive barrier system for a period of ten (10) years from date of final System installation.

B. Approval by System manufacturer for warranty is required prior to System installation.

C. Warranty Areas: All areas shown on Drawings to receive weather resistive barrier system shall be included in the warranty.

PART 2 - PRODUCTS

2.01 WEATHER-RESISTIVE BARRIER (WRB)

A. General: Provide all components and accessories required for a complete and functional watertight weather-resistant barrier system supplied by a single manufacturer, complete with manufacturer designed installation details for each condition found on the project.


1. Performance Characteristics:
   a. Air Penetration: 0.001 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677.
   b. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
   c. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
   d. Basis Weight: 2.7 oz/yd², when tested in accordance with TAPPI
Test Method T-410.

e. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.

f. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.

g. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.

h. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10.

C. Accessories:

1. Plastic Cap Screws: 2” diameter DuPont™ Tyvek® Wrap Cap Screws with 1-5/8” long drill point screws and high density polyethylene cap, manufactured by DuPont Building Innovations. Staples are not permitted.

2. Seam Tape: 3 inch wide DuPont™ Tyvek® Tape, manufactured by DuPont Building Innovations.

3. Flexible Flashing: Provide the following as recommended by the System manufacturer for the specific application or substrate condition:
   a. DuPont™ FlexWrap™, as manufactured by DuPont Building Innovations.
   b. DuPont™ StraightFlash™, as manufactured by DuPont Building Innovations.
   c. DuPont™ StraightFlash™ VF, as manufactured by DuPont Building Innovations.

4. Sealant: Provide the following sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions as recommended by System manufacturer.
   a. Tremco 830
   b. Tremco Butyl
   c. Other sealants recommended by the system manufacturer.

5. Primers: Provide the specific primer recommended by System manufacturer to assist in adhesion between flexible flashing and each different substrate found on this project:
   a. 3M High Strength 90
   b. Denso Butyl Spray
   c. SIA 655
   d. Permagrip 105
   e. ITW TACC Sta’ Put SPH
   f. Other primers recommended by the System manufacturer.

D. Sheet Metal Flashing: Specified in Section 07 62 00 - Sheet Metal Flashing And Trim.
PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate the installation of the weather-resistant barrier system and sheet metal flashings specified in Section 07 62 00 and the exterior siding/cladding so that the exterior sheathing and the weather-resistant barrier system are not left exposed to the weather longer than recommended by the manufacturer(s).

C. Coordinate fabrication and installation of sheet metal flashings with Section 07 62 00 as required to achieve a weather-tight assembly. Do not install cladding/siding until the flashings have been properly installed.

D. Coordinate installation of flexible flashing behind each masonry veneer anchor tie with Section 04 20 00.

E. Coordinate installation of flexible flashings at openings in exterior walls with installation of vapor retarder on interior face of walls to allow overlap and seal at openings.

3.02 EXAMINATION

A. Verify that substrates are ready to receive work.

B. Beginning of installation indicates acceptance of substrate and conditions.

3.03 PREPARATION

A. Substrates shall be clean, dry, and uniform and smooth prior to flashing application. Remove protrusions and fill voids at substrates as necessary. Ensure fastener heads are set flush with substrate surfaces.

B. Allow wet substrates to dry thoroughly. Clean dust and debris from all substrates. Wipe metal surfaces with films or coatings interfering with adhesion clean.

C. Prime substrates according to manufacturer’s recommendations.

D. Provide solid continuous backing or substrate filler to support all portions of self-adhering flashing.

E. Air and substrate surface temperatures for flexible flashing shall be as recommended by manufacturer.
3.04 INSTALLATION – WEATHER RESISTIVE BARRIER SYSTEM

A. Weathertight Installation: The exterior siding/cladding system and flashings (primary barrier) and the weather resistive barrier system (secondary barrier) installation shall be completely weathertight upon completion (no water penetration to interior side of weather resistive barrier), install in a manner that sheds water to exterior of wall and provides a completely weathertight building exterior.
   1. Remove, repair and replace any element of the exterior siding/cladding system (primary barrier) or the weather resistive barrier system (secondary barrier) that leaks or admits water behind the weather resistive barrier system to provide a weathertight exterior wall system.

B. General: The weather resistive barrier system is required to provide a completely watertight secondary barrier behind the exterior siding/cladding on this building.
   1. Install weather resistive barrier system over all surfaces of the exterior walls of the building in a weatherlapped, watertight manner and integrated with the sheet metal flashings around openings and penetrations.
   2. Coordinate installation to coincide with siding/cladding installation so that the proper sequence of installation is achieved and so that the weather resistive barrier system is not left exposed to the weather.
   3. Protect weather resistive barrier system from damage, repair any damaged areas for weathertight installation.

C. Weather Resistive Barrier System (WRB): Install WRB in accordance with System manufacturer's installation instructions to achieve weathertight assembly.
   1. Install weather resistive barrier sheet with minimum number of end laps possible.
   2. Openings: Install flexible flashing at perimeter of doors, windows and louvers in exterior walls to provide a weathertight seal between window, door or louver and the weather resistive barrier sheet.
   3. Penetrations: Install flexible flashing at perimeter of all penetrations of exterior siding (such as thru-wall scuppers, electrical boxes, hose bibbs, pipes, exhaust ducts/louver assemblies, light fixtures, fire alarm devices, structural members, etc) to provide a weathertight seal between item penetrating and the weather resistive barrier sheet.
   4. Masonry Veneer Anchor Ties: Install strip of flexible flashing behind each masonry veneer anchor tie, coordinate installation to occur prior to installation of ties with Section 04 21 13.
   5. Coordinate installation requirements at non-standard conditions with System manufacturer.
   6. Protect WRB from damage, repair any holes or tears before siding is installed.
   7. Do not leave WRB exposed to the weather, conform with manufacturer's recommendations. Replace any weather exposed or damaged barrier...
3.05 FIELD QUALITY CONTROL

A. Contractor Quality Control: Employ/assign quality control personnel to monitor the work of this Section for conformance to the requirements of the Contract Documents and to good construction practices.

1. Contractor is solely responsible for managing and controlling the quality of the work and conformance with the requirements of the Contract Documents.

B. Schedule of Contractor Performed Inspections:

1. Inspect installation of weather resistive barrier system just prior to cover and confirm that weather resistive barrier system is installed according to System manufacturer's recommendations and installation details and there are no penetrations or damage.

C. Manufacturer's Field Service:

1. Notify manufacturer's designated representative to obtain required periodic observations of weather barrier assembly installation.

2. System Manufacturer's Authorized Field Service Representative shall inspect work in progress and completed work to ascertain that the System has been installed according to System manufacturer's recommendations and installation details.

D. Non-conforming work shall be corrected and re-inspected/approved by System Manufacturer’s Authorized Field Service Representative prior to cover.

END OF SECTION
SECTION 07 40 00

METAL ROOF PANEL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section

1.01 SECTION INCLUDES

A. Pre-Finished Metal Roofing Panel System And Related Flashings/Trim.

B. Ice and water shield beneath metal roof panels with slope less than 3:12.

1.03 PERFORMANCE REQUIREMENTS

A. Environmental Requirements:
   1. Provide for expansion and contraction of system components due to changes in ambient temperature and solar heat gain. Accommodate movement due to temperature change without buckling, undue stress on structural elements, reduction of performance, or other damaging effects.
      a. Anticipated ambient temperature range: Minus 20 degrees to plus 180 degrees F.

B. Structural Design: Provide structural engineering design for the metal roofing systems, the wall panels, the substructure support framing system and the connections to the building structure.
   1. Design in conformance with the following:
      a. Design Wind Speed: As required by IBC for geographic location of this building
      c. IBC Chapter 16 – Section 1609 and tested in accordance with UL 580 and ASTM E1592.
   2. Include the design of substructure support framing system, clips and fasteners required to connect panels to building roof and wall structure and provide support/connection as recommended by the metal panel manufacturer.
   3. Include design calculations for drag load resistance on roofing panels.

C. Work Of Other Trades: Review and coordinate work of other trades that interface with or pass through the metal panel systems.
1. Make whatever provisions are necessary to the design, layout and fabrication of the metal panel systems to accommodate work by others.

D. Metal Roofing System Requirements:
1. Air Infiltration: 0.022 cfm per lineal foot when tested in accordance with ASTM E1680 at static test pressure differential of 12 psf.
2. Water Penetration: No leakage when tested in accordance with ASTM E1646 at static test pressure differential of 15 psf.
4. Fire Classification: UL Class A.

1.04 REFERENCES

A. All references shall be latest adopted edition.
B. ASTM A792 -- Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements
G. ASTM E1680 -- Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
H. Roofing Materials and Systems Directory; Underwriters Laboratories Inc. (UL)
I. UL 580 -- Tests for Uplift Resistance of Roof Assemblies; Underwriters Laboratories Inc.
J. IBC – International Building Code; 2009

1.05 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Manufacturer's written technical information, including performance data, details, and installation recommendations, which demonstrate that metal panel assembly components comply with contract documents. Include product data for rigid foam insulation.
C. Shop Drawings: Show plan view and arrangement of panels, spacing/layout of fastener clips and details of ridge cap, rake edge, eave edge, valley, roof/wall transition, roof slope change, fastener clips, interfaces with roof mounted accessories, etc.
   1. Include design for the substructure support framing, clips and fasteners connecting the panels to the building structure and accommodating the rigid insulation board.
   2. Shop drawings shall list metal panel system design criteria conforming to performance requirements specified in this Section.
   3. Shop Drawings shall be stamped by registered Professional Engineer currently licensed in the State in which the project is located.

D. Structural Calculations: Provide stamped and signed structural calculations prepared for this project by structural engineer currently licensed in the State in which the project is located, calculations shall address all applicable loads identified in the IBC.
   1. Include the design of substructure support framing, clips and fasteners connecting panels to building structure.

E. Samples for Verification of Coated Finishes: Submit two 4” x 6” samples cut from actual coated metal material for each finish type, texture, and color.

F. Installer Approval: Submit letter of installer approval/certification from roofing system manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company with a minimum of 10 years successful experience in the design, fabrication, and installation of metal roofing systems comparable in size and nature to those required for this project.

B. Installer Qualifications: Installer shall have a minimum of 5 years successful experience under the current business name in the installation of metal panel systems comparable in size and nature to those required for this project (upon request provide listing of all projects completed within the last 3 years along with names and phone numbers of owners and general contractors).
   1. Installer shall be approved by the Metal Roofing Manufacturer.

C. Field Measurements: Measure in-place construction on which metal roofing system will be installed if possible, before fabrication of panels. If not feasible, fabricate material to allow in-field trimming of panels to assure proper fit.

1.07 DESIGN RESPONSIBILITY

A. Metal Roofing System Design Responsibility: The metal roofing manufacturer is responsible for providing the technical design of a total metal roofing system, with all
associated materials, flashings, connections, details, etc. required to achieve a metal roofing installation that remains leak free for at least the duration of the warranty. Technical design by manufacturer shall be based upon and accommodate the configuration, layout and design elements of the metal roofing shown on the Contract Drawings.

1. The shop drawings approved by the metal roofing manufacturer are the Roofing System technical design drawings for use in construction. Roofing contractors bidding this roofing work shall base their bid on the requirements of the manufacturer’s specific roofing system and details as it will appear on the shop drawings.
   a. Coordinate the fabrication and installation of sheet metal flashings and components which form a part of the roofing system with Section 07 62 00 so that the completed roofing and flashing system is leak-free and conforms to the design requirements of the metal roofing manufacturer.

2. Metal Roofing Manufacturer shall provide and/or approve all materials used in the application of the metal roofing system.

3. Metal Roofing Manufacturer shall approve installation methods used in the application of the metal roofing system.

4. Metal Roofing Manufacturer shall provide clear instruction to the installer on:
   a. Environmental requirements for storage and installation.
   b. Approved installation requirements of the metal roofing materials.
   c. Installation sequence.
   d. Proper assembly of the materials into a metal roofing system designed to provide a watertight roofing assembly.

1.08 DELIVERY, STORAGE & HANDLING

A. Deliver, store and handle products as recommended by manufacturer to prevent damage or discoloration.

1.09 WARRANTY

A. Contractor’s Warranty: Warrant metal roofing system installation, including panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for one (1) year following Project Substantial Completion date.

B. Coating Warranty: Warrant coated finish against cracking, peeling, blistering, chalk in excess of 8 units, and fade in excess of 5 NBS points, for a period of 20 years, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents.

C. Manufacturer shall also warrant for twenty (20) years that metal will not fail structurally, perforate, rupture or leak due to corrosion.
PART 2 - PRODUCTS

2.01 PREFINISHED METAL ROOFING SYSTEM

A. Manufacturer
1. Manufacturer/Product: Specification and design are based on AEP Span metal roofing systems.
2. Other acceptable manufacturers include:
   a. Metal Sales Manufacturing Corporation
   b. Bryer Company
   c. Architectural Metal Solutions
   d. McElroy
   e. Taylor Metals
3. Other manufacturers may be acceptable, subject to their ability to provide products conforming with the requirements of this Specification.
4. Substitutions: Comply with Section 01 60 00, proposed substitutions must match specified product, selected colors and be approved by Architect.

B. Factory Pre-Finished Sheet Metal: Steel sheet with minimum yield of 40,000 psi conforming to ASTM A792 coated with AZ50 zinc-aluminum alloy (Zincalume or Galvalume).
   1. Factory Finish
      a. Finish Coating (Weather Side): Premium fluoropolymer coating with minimum of 70% Kynar 500 or Hylar 5000 base resin, factory-applied, oven baked and applied under controlled conditions; 20 year warranty.
      b. Underside/Backside Finish: Manufacturer's standard corrosion-inhibiting wash coat.
   2. Protective film: Provide strippable plastic film, applied to finish of coil stock before forming, or plastic interleaf, applied to panel after forming.

C. Standing Seam Metal Roofing System: AEP Span, factory roll-formed standing seam roofing system with concealed fasteners for attaching metal roofing system to primary building structure. Basis of Design Product is AEP "Design Span", 17 inch net coverage panel width; panels rated for 3 in 12 slope, concealed fastener application Color as noted on the Drawings.
   1. Application: Concealed fastener standing rib roofing panel.
   3. Panel Width: 16 inch nominal width
   4. Panel Gauge: 24 gauge
   5. Seam Type: 2 inch high standing seam with factory applied sealant and seamed in field with electric seaming tool.
   6. Pan Style: Flat pan with 2 small ribs.
   7. Panel Length: Refer to Drawings and field measurements.

E. Standing Seam Roofing System Accessories:
1. Fastener Clips: Type required by manufacturer to meet structural design criteria, UL rated, G90 galvanized steel.
2. Underlayment: Self-adhering, reinforced SBS modified rubberized asphalt sheet; Protecto Wrap Jiffy Seal Ice & Water Guard or approved.
3. Sheet Metal Flashing, Closures, and Trim: Provide as specified in Section – 07 62 00 and as required by metal roofing system manufacturer.
   a. Fabricate from 24 gauge factory finished steel sheet, and with same coating, finish and color as adjacent roofing panel.
4. Sealants And Gaskets: Provide metal roofing system manufacturer's recommended sealant.
5. Roof Penetrations: Provide metal roofing system manufacturer's recommended flashing system.
6. Self adhering waterproof membrane: Self adhesive flashing as manufactured by Certainteed Corporation WR Grace. Type: Winterguard HT (high temperature), waterproofing underlayment or approved substitution.

F. Accessories:
1. Furring Channels: Where framing shown on Drawings is not adequate for support of panels, provide G-90 galvanized steel hat channels or other framing members, size and configuration as required by conditions for proper support of panels, 18 gauge minimum.
2. Fasteners: Provide manufacturer's recommended galvanized steel corrosion-resistant screw fasteners and anchors of size and type required for intended application and substrate conforming to structural design criteria.
   a. Use of cadmium-plated fasteners is not allowed.
3. Profile Closures Strip: Closed-cell neoprene rubber, die-cut to fit panel profile with 5 to 10 percent compression.
4. Sheet Metal Flashings and Trim:
   a. Fabricate from 24 gauge factory finished steel sheet, with same finish and color as adjacent wall panels.
   b. Soffit Panels: Provide all perimeter trim and flashings required for a complete, soffit panel system in accordance with manufacturer's standard details and as shown on the Drawings, including perimeter flashing, flashing at penetrations, etc.
   c. Comply with sheet metal fabrication standards specified in Section 07 62 00.
5. Exposed Joint Sealant: Provide as specified in Section 07 90 00.
7. Penetrations: Provide metal panel system manufacturer’s recommended penetration flashing system.

2.03 FABRICATION

A. Coordinate and confirm field dimensions and conditions prior to fabrication.

B. Factory form metal panels in continuous one-piece lengths; site formed panels are not allowed.
1. Fabricate panels to profiles and configuration required by metal panel manufacturer and as shown on the Drawings for watertight assembly.

C. Shop fabricate flashing and trim in prefinished sheet metal matching wall and roof panels in longest lengths practical to profiles and configuration required by manufacturer and as shown on the Drawings.
   1. Conform to fabrication requirements specified in Section 07 62 00.
   2. Gauge: 24 gauge minimum; increase thickness where recommended by manufacturer or where field conditions require additional stiffness to avoid waviness or visible deflection.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate installation of sheet metal flashings with Section 07 62 00 for proper sequence and for watertight assembly.

C. Coordinate work with other adjacent elements of building envelope to ensure watertight construction.

D. Coordinate and accommodate openings and penetrations required by other trades.

3.02 EXAMINATION

A. Verify that substrate and structural to receive work of this section is complete, properly sized and is laid out correctly in plan and elevations in conformance with the shop drawing.

B. Confirm that structural elements, to which the metal panels will be attached, are adequate to provide secure attachment of the metal panels.

C. Confirm that framing/backing is installed for support and fastening metal panels and furring.

D. Confirm that substrate (framing/sheathing/decking) is plumb and straight, and that surface plane is within ¼ inch in 10 feet tolerance.

E. Inspect secondary barriers (weather resistive barrier and flexible flashings) for proper installation that will provide watertight installation.

F. Report any variations and potential problems; do not start work until unsatisfactory conditions have been corrected.
G. Start of installation indicates acceptance of the substrate, structural system, secondary weather resistive barriers and site conditions.

3.03 INSTALLATION – STANDING SEAM METAL ROOFING SYSTEM

A. Install metal roofing system straight and square with building lines in accordance with manufacturer's recommended installation instructions and approved shop drawing to achieve a watertight installation.
   1. Field Seaming: Field bend seams with electric seaming tool in accordance with manufacturer's instructions.

B. Install metal roofing panels in single, continuous length from eaves to ridge.

C. Install roofing panels using concealed fastener clips inserted in panel seams.

D. Fasten clips/panels to structure as required by manufacturer's structural design to comply with specified Performance Requirements, allowing for expansion and contraction due to temperature variations and building movement.

E. Install gaskets, sealants, closures and flashing/trim as the work progresses to ensure airtight and watertight performance of the completed installation.

F. Install ice and water shield at all roof slopes less than 3:12.

G. Flashing:
   1. Install flashing at the following locations: Roof top equipment, mechanical and electrical vents and conduit penetrations, valleys, ridges and rakes. Install in accordance with manufacturer's instructions and reviewed Shop Drawings.
   2. Install to allow for thermal movement.

I. Cutting and Fitting:
   1. Neat, square, and true. Torch cutting and saw cutting is prohibited.
   2. Shop fabricate and reinforce openings 6 inches and larger in any direction to maintain original load capacity.
   3. Do not use pencil to make marks on panels.
   4. Utilize gloves while handling panels to minimize fingerprints and oils.

3.04 INSTALLATION - METAL SOFFIT PANEL SYSTEM

A. Install metal soffit panel system straight and square with building lines in accordance with manufacturer's recommended installation instructions and approved shop drawing.
B. Fasten panels to framing as necessary to comply with Performance Requirements and structural design, allowing for expansion and contraction due to temperature variations and building movement.

C. Install panels in one continuous piece for length of soffit.

D. Install gaskets, sealants, closures, and flashings/trim as the work progresses to ensure airtight and watertight performance of the completed installation.

3.05 CLEANING AND PROTECTION

A. Remove protective coverings from prefinished metal surfaces after each panel is installed.

B. Remove all loose fasteners, metal scraps and debris and sweep clean.

C. Replace any panels or flashing/trim that has damage to the paint coating that voids the manufacturer’s warranty or where damage is visible.

D. Clean finished surfaces using techniques and materials recommended by panel manufacturer. Protect cleaned surfaces until project completion.

E. Prevent traffic across metal roofing after installation is complete.

END OF SECTION
SECTION 07 41 00
METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Vapor Retarders: Section 07 26 00.
   2. Sheet Metal Flashing and Trim: Section 07 62 00.

1.2 REFERENCES

0. A 446 - "Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality."

1.3 SUBMITTALS

A. Product Data: Factory coating and finish specifications, and manufacturer's standard color charts.

B. Shop Drawings: Show factory coating and finish specifications, gages, profiles, fastener types and locations, installation and flashing details.

C. Samples: 12 inch long by full panel width of specified panel configuration.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer shall have a minimum of 5 years experience in manufacture of metal wall panel systems of size, type, and quality shown and specified.
   2. Installer shall have a minimum of 5 years experience installing siding panel systems of the type specified and be certified, in writing, by the metal wall panel materials manufacturer.

B. Pre-installation Conference:
   1. Arrange and participate in a coordination meeting to be attended by all installers and material manufacturers’ representatives involved in the Work specified and in related Sections to review and prepare written step-by-step application procedure, including a written detailed Statement of Work and Shop Drawings for a complete metal wall panel system.
      a. Following the pre-installation conference, furnish a written statement with date of meeting, names and affiliations of participants.
b. Also furnish written list of any modifications of Contract Documents proposed in the step-by-step application procedure. Such modifications shall be done at no increase in Contract Sum.

2. Work of this Section shall not proceed until the Architect has reviewed and accepted the documents to be submitted following the pre-installation conference.

3. Prior to starting Work, arrange a Jobsite meeting with the Architect and participants in the pre-installation conference to discuss Contract Documents, accepted step-by-step application procedure, Shop Drawings, job and surface readiness, and material storage and protection.

4. Notify Architect 2 calendar days prior to Jobsite Meeting, starting Work and, if Work is done intermittently, before restarting Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels packaged to adequately protect from damage during shipment and storage. Protect panels from adverse job conditions prior to installation.

1.6 WARRANTY

A. Manufacturer's standard 20 year warranty that under normal usage panels will not rupture, fail structurally, or perforate due to corrosion.

B. Paint System: Manufacturer's standard 20 year warranty against peeling and blistering.

C. Workmanship Warranty: Manufacturer's standard warranty that roof system is installed in accordance with manufacturer's recommendations and will be free from defects and remain watertight and weatherproof with normal usage for 2 years following date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. AEP Span, Taylor Metals, Metecno, Morin Profiles or approved substitutions.

2.2 MATERIALS

A. Panel Type 1: Wall panels to be AEP Span “Mini V Rib” wall application. See Drawings for locations. Color: See Drawings.

1. Lengths: Provide maximum panel lengths recommended by manufacturer to minimize end laps.

2. Base Metal: Steel, ASTM A 446, G-90, 24 gage, Panel 1, 26 gauge Panel 2.

3. Protective Coating: Conforming to ASTM A 792, 45 percent zinc and 55 percent aluminum by weight, 1.9 mil thickness.
4. Exterior Finish: 0.8 mil Polyvinylidene Fluoride, Kynar-500 70 percent resin finish applied over 0.2 mil baked on epoxy base primer for a total film thickness of 1.0 mil. Color as selected from manufacturer's standard colors.

5. Fasteners: Manufacturer's standard gasketed tek screws.

B. Flashing: Material and finish to match panels. Dissimilar materials will not be allowed. Panel penetration flashing as required.

C. Underlayment: As specified in Section 07 27 00 Weather Resistive Barrier System.

E. Sealants:
   1. Gunable Sealant: As specified in Section 07900.
   2. Sealant Tape: Tremco MBT-35 Metal Building Tape or approved.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate is installed and aligned to panel manufacturer's tolerances.

3.2 INSTALLATION

A. Install building paper, flashing, and accessories in accordance with manufacturer's specifications for high wind areas.

B. Building Paper: Apply one ply of No. 30 asphalt felt, laid parallel to wall surfaces, lap 2 inches on sides, and 4 inches on ends. Nail sufficiently to hold in place.

C. Panels:
   1. Install in accordance with manufacturer's instructions and reviewed Shop Drawings. Secure panels without warp or deflection.

E. Erection Tolerance: Maximum alignment variation, 1/4 inch in 40 feet.

F. Flashing:
   1. Install flashing at the following locations: exterior and interior corners, door, window penetrations, beam and column caps and misc. locations as shown on the Drawings. Install in accordance with manufacturer's instructions and reviewed Shop Drawings.
   2. Install to allow for thermal movement.

G. Cutting and Fitting:
   1. Neat, square, and true. Torch cutting and saw cutting is prohibited.
   2. Shop fabricate and reinforce openings 6 inches and larger in any direction to maintain original load capacity.
   4. Do not use pencil to make marks on panels.
   5. Utilize gloves while handling panels to minimize fingerprints and oils.
H. Remove any strippable protective coating on panels and flashings prior to installation. Do not allow strippable material to remain on panels in extreme heat, cold, or in direct sunlight or other UV source.

I. Fasten and seal wall panels to provide a complete watertight and weathertight installation.

3.3 CLEANING
A. Touch up areas as required. Wash panel surfaces with water if required.

END OF SECTION
SECTION 07 46 49
FIBER CEMENT SIDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES
A. Fiber Cement Lap Siding

1.03 SUBMITTALS
A. Refer to Section 01 33 00 for submittal procedures.
B. Product Data: Submit product data for support substructure, fiber cement lap siding, soffits, screws, and sealant.
C. Shop Drawings – Substructure for Siding: Provide drawings showing layout, details and attachment of the substructure support system for the siding stamped and signed by licensed Professional Engineer, registered with the State of Washington.

1.04 PRE-INSTALLATION CONFERENCE
A. Prior to start of siding and trim installation, Contractor shall schedule a pre-installation conference at the job site to review the project conditions and installation requirements. Persons attending pre-installation conference shall include the General Contractor, Siding/Soffit Installer, Architect, Owner representative.

1.05 DELIVERY, STORAGE & PROTECTION
A. Store off the ground and cover to protect from exposure to the elements.

PART 2 - PRODUCTS

2.01 FIBER CEMENT SIDING
A. James Hardi fiber reinforced cement, 5/16”, 4’ x 8’ or 4’ x 10’ sheets, pre primed.
B. Accessories:
   1. Weather-Resistive Barrier (WRB): Specified in Section 07 27 00.
2. Sheet Metal Flashing & Trim: Specified in Section 07 62 00.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate the layout/location of wall framing and backing with Section 06 10 00 as required for support/attachment of substructure.

C. Coordinate layout and installation of wood framing/backing with Section 06 10 00 to provide proper layout for support of the substructure in locations required for siding and trim.

D. Coordinate fabrication and installation of sheet metal flashings with Section 07 62 00 as required to achieve a weathertight assembly. Do not install siding until the flashings have been properly installed.

3.02 WEATHERTIGHT INSTALLATION

A. Siding, weather resistive barrier and flashing system installation shall be completely weathertight upon completion, install in a manner that sheds water to exterior of wall and provides a completely weathertight building exterior.

B. Remove, repair and replace any element of the complete siding system that leaks or admits water behind the building paper to provide a weatherproof siding system.

3.03 EXAMINATION

A. Verify that substrates are ready to receive work.

B. Confirm that framing/backing is installed for support and fastening all siding and soffit joints and ends.

C. Confirm that framing/sheathing is plumb and straight, and that surface plane is within ¼ inch in 10 feet tolerance.

D. Inspect secondary barriers (weather resistive barrier and flexible flashings) for proper installation that will provide watertight installation.

E. Beginning of installation indicates acceptance of substrate, framing/backing, secondary barriers and conditions
3.04 PREPARATION

A. Protect weather-resistive barrier and flexible flashings from damage.

3.05 INSTALLATION – FIBER CEMENT SIDING

A. Install siding level, straight and true in accordance with siding/trim manufacturer’s installation instructions for each different type of siding.
   1. Lap Siding:
      a. Siding Exposure: Install siding with specified exposure.
      b. Fastening: Screw siding securely to substructure vertical girts.

B. Cuts Exposed To View: Cut with diamond blade circular saw to achieve a neat straight cut, do not score and snap.

C. Field coat all cut ends with manufacturer’s recommended sealer/primer.

D. Lap Siding Butt Joints: Install lap siding in longest lengths possible with minimum number of joints, do not use short lengths where full length piece would eliminate joint.
   1. Lay out butt joints to occur randomly on the wall, so that no discernable pattern is visible, stagger the joints between rows of siding.
   2. Joints shall be cut square and true.
   3. Locate joints over centerline of wall framing members, joints located at sheathing only are not allowed.
   4. Lap Siding Butt Joints: Install a 12” x 12” piece of flexible flashing behind butt joints with bottom edge lapped over siding below (hold up 1/2” above bottom of siding to conceal from view) to prevent water penetration at joints. Apply 2 vertical beads of sealant onto flexible flashing 4 inches each way from joint.

E. Sealant Installation: Apply sealant neatly as recommended by manufacturer and specified hereafter:
   1. Clean siding and trim before applying sealant.
   2. Apply sealant to WRB/flexible flashing substrate (behind) as siding installation progresses and place siding into fresh sealant; wipe off excess sealant leaving a neat joint; the intent is for sealant to be behind the siding and in the joint. Do not wait to apply sealant after siding is installed.
   3. Install sealant in the following locations:
      a. At juncture between siding and trim; apply 2 vertical beads of sealant, one at the end of the siding (to act as the primary seal) and a second vertical bead 4 - 5 inches from end of siding (to act as the secondary seal).
      b. At lap siding end (butt) joints; apply 3 vertical beads of sealant, one bead centered on the joint (to act as the primary seal) and the other two beads 4 – 5 inches each way from the first bead (to act as the secondary seal).
3.06 WORKMANSHIP

A. Fiber cement siding and trim installation shall be installed using the best workmanship, including but not limited to the following:
1. Surfaces of siding and trim shall be free of dirt, scratches, dents or damage.
2. Siding and trim shall run plumb, straight and true, parallel with building lines.
3. Butt joints in lap siding shall be cut square with consistent appearance.
4. Trim joints shall be tight and cut square.
5. All work shall be securely fastened and free of loose fit.
6. Sealant installation shall be neat and free of excess or rough sealant.
7. Installation shall conform to manufacturer’s installation instructions.

B. Any part of the siding and trim installed with improper or poor workmanship shall be removed and replaced at Contractor’s expense.

3.07 FIELD QUALITY CONTROL

A. Contractor Quality Control: Employ/assign quality control personnel to monitor the work of this section for conformance to the requirements of this section and to good construction practices.
1. Contractor is solely responsible for managing and controlling the quality of the work and conformance with the requirements of this Section.

END OF SECTION
SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Sheet metal flashing and trim
B. Sheet metal gutters
C. Thru-wall flashing
D. Downspouts

1.03 REFERENCES

A. All references shall be the latest adopted edition, except as noted.
B. ASTM A653 - Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
C. ASTM A792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
E. NRCA (National Roofing Contractors Association)

1.04 SUBMITTALS

A. Refer to Section Section 01 33 00 for submittal procedures.
B. Product Data: Submit manufacturer’s product data for the following:
   1. Pre-Finished Sheet metal
   2. Fasteners
   3. Sealant
C. Submit shop drawings for review prior to fabrication, include the following:
1. Roof details showing each flashing condition keyed to the roof plan.
2. Profile and dimensions of each sheet metal item, gauge, type/finish of sheet metal, fastener type, location and spacing.
3. Corner and end details for each different flashing type.
4. Downspouts section and details of bends, hangars and connections to gutter outlet tube and to storm drainage system.
5. Fastener material, type and size for each condition.
6. Sealant details showing joint configuration, sealant types and location for each condition.

D. Color Samples For Prefinished Sheet Metal: Submit two 3” x 4” color samples of each standard color selected in Section 01 84 19 (actual paint finish on sheet metal).

E. Fastener Samples: Submit samples of each different type of fastener proposed for use, key the fasteners to the fasteners noted in the shop drawings.

1.05 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications:
1. Minimum of 5 years experience in fabrication and installation of architectural sheet metal similar in material, design, and scope to this project with a record of successful in-service performance.
2. Installer shall employ only skilled, journeyman sheet metal workers to install the work of this section.

B. Workmanship shall be of the best quality; installed work shall be straight and true with neat corners and terminations, free of any visual defects; installation shall be fabricated and installed to inherently shed water without reliance on sealant and be permanently watertight.

1.06 WARRANTY/GUARANTEE

A. 20 Year Pre-finished Sheet Steel Warranty: Warrant coated finish against cracking, peeling, blistering, chalk in excess of 8 units, and fade in excess of 5 NBS points, for a period of 20 years, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents. Manufacturer shall also warrant that metal will not fail structurally, perforate, rupture or leak due to corrosion.

B. 1 Year Installer’s Guarantee: The Contractor shall guaranty the sheet metal installation for a period of 1 year against defects in installed materials and workmanship including a 1 year watertight guaranty. Correct any flashing or sheet metal item that is defective, improperly installed or leaking for a period of 3 years.
PART 2 - PRODUCTS

2.01 MATERIALS

A. Pre-Finished Sheet Metal: Steel sheet conforming to ASTM A792 with minimum yield of 40,000 psi and AZ50 (Zincalume or Galvalume) protective coating.
   1. Finish Coating shall be a premium fluoropolymer coating with minimum of 70% Kynar 500 or Hylar 5000 base resin, factory-applied, oven baked and applied under controlled condition; 1 mil dry film thickness minimum (exclusive of primer); 20 year warranty.
   2. Color: As noted on the Drawings.
   3. Protective film: Provide strippable plastic film, applied to finish of coil stock before forming, or plastic interleaf, applied to panel after forming.
   4. Manufacturers: Same manufacturer providing preformed metal roofing panels specified in Section 07 40 00.

B. Stainless Steel Sheet: Conform to ASTM A 666, Type 304, mill finish.

C. Solder Metal: Conform to ANSI/ASTM B32, provide flux formulated for specific metal to achieve permanent bond to metal substrate.

2.02 ACCESSORIES

A. Fasteners: All fasteners shall be manufactured in the United States or Canada.
   1. Fasteners For Pre-Finished Sheet Metal Fabrications:
      a. Exposed Condition – Wood or Sheet Metal Substrate: Type 304 stainless steel screws with self-sealing neoprene head.
      b. Exposed Condition – Masonry/Concrete Substrate: 1/4” diameter Rawl Zamac Nailin expansion anchor with mushroom style head, and body formed of Zamac 7 alloy, Type 304 stainless steel nail; 1-1/2” minimum embedment; seal head with sealant.
       1) Powder/power driven fasteners are not permitted.
      c. Concealed Condition: Hot dipped galvanized nails or screws or expansion anchors as appropriate for the substrate.
       1) Powder/power driven fasteners are not permitted.
   2. Fasteners For Continuous Cleats (Concealed): Hot dipped galvanized screws, nails or expansion anchors as appropriate for the substrate.
      1) Powder/power driven fasteners are not permitted.
   3. Fasteners For Downspout Brackets:
      a. Into Sheet Metal: Stainless steel sheet metal screws.
      b. Into Masonry/Concrete: Stainless steel expansion anchors, 1/4” diameter (minimum), 1-3/4” embedment (minimum).
       1) Powder/power driven fasteners are not permitted.

B. Gutter End & Outlet Tube Sealant: Alcoa Gutterseal.

C. Tape For Separation Between Dissimilar Metals: 10 mil PVC adhesive backed tape.

D. Sealant: Provide sealant and accessories specified in Section 07 90 00.
2.03 FABRICATION

A. General:
1. Field measure and verify site conditions prior to fabrication, accommodate field conditions.
2. Fabricate in accordance with SMACNA (Architectural Sheet Metal Manual, Sixth Edition, 2003), NRCA and as required by roofing manufacturer to profiles shown on Drawings (where conflicts exist, the most restrictive requirement shall apply).
3. Form sections true to shape, accurate in size, square, and free from distortion or defects.
4. Furnish in minimum 10’ lengths.
5. Hem all exposed edges 1/2 inch on underside.
6. Lap joints shall be fabricated to allow 6 inches minimum overlap.
7. Fabricate head flashings in walls (at windows, louvers, etc.) with end dams to prevent water running off ends and behind siding.
8. Shop fabricate all items including corners, end terminations and special conditions for neat appearance, field bending and fabrication is not acceptable.
9. Protect pre-finished metal from scratches or damage during fabrication.
10. End conditions, corners, transitions, terminations, and changes in the plane or direction of flashings, copings, cornices, gutters and other sheet metal fabrications shall be custom fit and fabricated to accommodate field conditions and to provide a weatherlapped, watertight assembly and transition. Workmanship and custom fabrications shall conform to similar conditions found in SMACNA Manual and to good sheet metal fabrication practice and shall not rely solely on sealant for their watertight integrity.

B. Reglets & Counter Flashing: Fabricate to match configuration shown on the Drawings from prefinished sheet metal, 24 gauge or as shown on Drawings.
1. Lay out and fabricate for 6 inch lap joints.
2. Fabricate for tight spring action contact to roofing/wall behind; provide wind restraint clips at bottom of counter flashing where tight spring fit cannot be achieved.
3. Counter Flashing Corners: Fabricate watertight with neat appearance, bend at corner and extend past corner at least 12 inches.

C. Gutters: Fabricate to match gutter size and configuration/profile shown on Drawings from pre-finished sheet metal; minimum 24 gauge.
1. Gutter Profile/Dimensions: As shown on Drawings.
2. Gutter Thermal Movement: Allow space for thermal expansion/contraction of gutter when fabricating gutters between fixed points or with gutter return around corner to prevent buckling or pulling apart of corner joints; refer to SMACNA Manual for recommended allowance for expansion/contraction based on metal type, gutter length and 160 degree F temperature differential.
a. Anchor Points: Screw attach gutter to eave hangar flashing at a single location mid-point of gutter length or as noted on Drawings to allow gutter expansion/contraction in both directions from fixed...
3. Lap Joints: Lap gutter sections 4 inches minimum.
   a. Seal watertight with Gutter Sealant.
   b. Install solid head rivets for secure connection, paint rivet heads to match gutter color.
   a. Seal watertight with Gutter Sealant.
   b. Install solid head rivets for secure connection.
5. End Closures: Provide watertight end closures, fabricate to fit gutter profile:
   a. Seal watertight with Gutter Sealant.
6. Outlet Tubes: Provide 4 inch long round drain outlet tubes at each downspout location fabricated with turned flange top per SMACNA Figure 1-24C; seal and rivet for watertight joint; size diameter to fit easily into downspout pipe. Install in gutter similar to SMACNA Figure 1-33D;
   a. Seal lap joint watertight with Gutter Sealant and attach securely to gutter with solid head rivets.
7. Gutter Support: Provide continuous eave flashing interlocked into continuous support hook at top of gutter for hanging gutter as shown on Drawings.
8. Gutter Straps: Provide 22 gauge pre-finished sheet metal straps locked into front seams on gutter and securely fastened to roof eave.

D. Downspouts and Supports: Fabricate downspouts from 24 gauge pre-finished sheet metal; downspouts shall extend between drain outlet tube at gutter/roof and storm drain system on grade or as shown on Drawings; fabricate fittings required to accommodate conditions.
1. Layout and cut downspout for neat installation; align plumb and square with walls; slope horizontal sections down at the 1” per foot slope.
2. Downspout Supports: Fabricate from pre-finished sheet metal similar to SMACNA Figure 1-35E, 20 gauge and with equal spacing not exceeding 5 to 6 feet or as indicated on drawings.
3. Splash Pan: Fabricate to match configuration shown in SMACNA Figure 1-36 from 24 gauge prefinished sheet metal.
   a. Hem all edges.
   b. Rivet corners
   c. No sharp corners or edges.

E. Miscellaneous Flashings: Fabricate to match profiles/configurations shown on Drawings from 24 gauge factory pre-finished sheet metal.
1. Slope horizontal leg of flashings to provide positive water drainage.
2. Provide end dams at all head and sill flashings to prevent water from leaking off ends.

F. Window Sills/Sillpan: Fabricate to match profile/configuration shown on Drawings from 24 gauge factory pre-finished sheet metal.
1. Sills shall extend full depth to interior face of window frame.
2. Provide concealed back and end dams with corners lapped, riveted and sealed watertight.
3. Hem exposed edge 1/2 inch.
G. Sheet Metal Fillers and Miscellaneous Fabrications: Fabricate from 22 gauge prefinished galvanized sheet steel to match configuration shown on the Drawings.

1. Field verify dimensions and connections.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate installation of sheet metal flashings with Section 07 52 16 for proper sequence and for watertight assembly.

C. Coordinate gutter outlet tube location to align with storm drainage inlet pipe at ground level.

D. Schedule installation of window sill/sillpan flashing prior to window installation.

3.02 PREPARATION

A. Field verify that existing conditions and substrate layout are acceptable and comply with Drawing layout.

B. Report any variations, unacceptable substrates/conditions and potential problems.

C. Do not start work until unsatisfactory conditions have been corrected.

D. Start of installation indicates acceptance of substrate and conditions.

3.03 INSTALLATION - GENERAL

A. Installation shall conform to this Section and the Drawings, the roofing manufacturer’s requirements, SMACNA Architectural Sheet Metal Manual and NRCA Roofing Manual (where conflicts exist, the most restrictive requirement shall apply).

B. Protect pre-finished metal from scratches or damage during fabrication.

C. Separate dissimilar metals with 2 wraps/layers of PVC tape.

3.04 INSTALLATION - FLASHINGS

A. Install flashings to achieve a weathertight, leak-free installation.

B. Install flashings straight and true with neat appearance.
C. Lap Joints: Lap 6 inches minimum and seal with two heavy beads of butyl sealant just prior to making lap;
   1. Clean metal surfaces to be sealed thoroughly with solvent just prior to sealant application;
   2. Trim off back of hem to allow tight interface and proper fit.
   3. Flashing shall fit tight to each other, free of any gaps or misfit.

D. Fasten flashings to substrate securely using specified fasteners sized to hold flashings securely and as recommended by manufacturer for substrate and condition.
   1. Powder/power actuated fasteners are not permitted.

E. Fasteners shall be concealed wherever possible, seal exposed fasteners watertight.

3.05 INSTALLATION – GUTTERS

A. Install straight and true and as required to achieve a watertight, leak-free installation.

B. Connect to support structure securely to provide support when completely full of water without deflection, sagging or overstressed connections.

C. Gutter Field Joints: Construct riveted and soldered watertight joints, corners and end closures as described under Fabrication in this Section.

D. Locate drain outlet at each downspout location.

3.06 INSTALLATION - DOWNSPOUTS

A. Install downspouts plumb and square with building, place in location shown on Drawings.

B. Hold horizontal downspout sections as high as possible.

C. Cut and fit downspouts accurately, fabricate watertight joints. Extend downspout into storm drain line at bottom.
   1. Clean, prime and cement pipe joint/fittings in accordance with manufacturer's instructions for watertight joints.
   2. Attach downspout to wall securely with mounting brackets attached with fasteners appropriate for the wall substrate.
      a. Lay out mounting brackets so that all downsputs have matching symmetrical appearance, with no more than 4 feet between brackets.
      b. Mounting bracket shall hold downspout pipe firmly in place without slippage or movement.
   3. Provide PVC transition fitting for connection to underground storm drain system.

3.07 INSTALLATION - SEALANT
A. Install sealant as specified in Section 07 90 00.

1. Exposed Sealant Joints: Clean and prime surfaces to be sealed in accordance with sealant manufacturer's instructions. Install backer rod and sealant in accordance with the sealant manufacturer's installation requirements to achieve the proper sealant performance. Install sealant so that width, shape, bonding width and width to depth ratios conform to sealant manufacturer's joint design recommendations based on the amount of movement (expansion/contraction) anticipated at each joint condition to achieve a permanently watertight joint.

2. Concealed (Lap) Sealant Joints: Clean and prime surfaces to be sealed in accordance with sealant manufacturer's instructions. Install two continuous beads of butyl sealant (primary and secondary) at each lap joint to achieve a watertight connection.

3. Exposed Fastener Heads: Where fastener heads are exposed to the weather and not self-sealing type, install sealant over fastener head and seal to metal surface watertight.

END OF SECTION
SECTION 07 8400

FIRESTOPPING/SMOKE SEAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 WORK INCLUDES

A. Firestopping and Smoke Seal Systems

1.03 SCOPE OF WORK

A. Provide Firestopping/Smoke Seal System(s) conforming to IBC, ASTM E814 and requirements of the authority having jurisdiction at the following locations:
   1. Around structural, mechanical, electrical and other penetrations through fire rated assemblies.
   2. At cracks, gaps and openings in fire rated assemblies.
   3. At perimeter of fire rated assemblies where there are cracks, gaps, voids or openings.

1.04 REFERENCES

A. All references shall be the latest adopted edition, except as noted.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops

C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition

D. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition

E. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition


G. WH (CERT) - Certification Listings; Warnock Hersey
1.05 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

1.06 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping/smoke seal system designs which provide the required fire ratings when tested in accordance with ASTM E814.
   1. Listing in the current classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.

B. Installer Qualifications: Installer shall have at least 5 years of experience installing firestop systems in buildings of similar construction to that found on this project.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation.

PART 2 - PRODUCTS

2.01 FIRESTOPPING/SMOKE SEAL SYSTEMS

A. Manufacturers/Product Group and ICC Evaluation Service Report Number:

B. Firestopping/Smoke Seal System(s): Provide complete Firestop/Smoke Seal System(s) that conform to the requirements of Chapter 7 of the International Building Code (IBC) and are designed, tested and fire-resistance rated to resist for a prescribed period of time the spread of fire through each different type of penetration, fire rated assembly and construction type found in this Project.
   1. Firestop/Smoke Seal System(s) shall be tested and listed by one of the testing agencies listed in 1.04 above.
   2. The F and T rating criteria for the Firestop/Smoke Seal System(s) shall be in accordance with ASTM E814 and IBC.
   3. Firestopping/Smoke Seal Exposed To View: Firestop/Smoke Seal System must either be concealed from view behind the finish; or have an appearance matching the adjacent finish appearance and be paintable; or have a suitable finished trim or escutcheon to cover the firestopping.
4. Provide firestopping/smoke seal products from the same manufacturer on any single assembly or condition, do not mix different manufacturer's products.

C. Rock Wool: Rock wool insulation spun from slab or basalt rock; 2.8 pound density, with formaldehyde-free binder, friction fit, unfaced, conform to ASTM C665; Roxul AFB or approved.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate the timing of when to execute the work of this section with the work of other trades.

C. Coordinate firestopping/smoke seal at mechanical and electrical penetrations made by Divisions 20 through 28.

3.02 EXAMINATION

A. Verify that all penetrations and openings are completed and ready to receive the work of this section.

3.03 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that may affect bond of firestopping material in accordance with manufacturer’s instructions.

B. Remove incompatible materials that may affect bond.

3.04 INSTALLATION

A. Select the specific firestopping/smoke seal assembly that will provide the specific fire rating required for the type of construction and conditions found and that conforms to the criteria stated in the testing agency listing.

B. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing cracks/gaps and providing a firestop of each gap/crack in a fire-rated assembly equal to the fire rating of the assembly.

C. Where firestopping/smoke seal is exposed to view, finish to match adjacent surfaces.
3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces of firestopping/smoke seal materials.
B. Protect adjacent surfaces from damage by material installation.

3.06 FIRESTOPPING LOCATIONS

A. Install firestopping/smoke seal in all locations required by the IBC and Authorities Having Jurisdiction.
B. Install firestopping/smoke seal at cracks, gaps or openings within and around perimeter of fire rated wall, floor or roof assemblies (refer to Drawings for location of rated assemblies).
C. Install firestopping/smoke seal around penetrations (structural, mechanical and electrical) through fire rated assemblies; coordinate with structural mechanical and electrical work.
D. Install firestopping/smoke seal wherever noted on Drawings.

END OF SECTION
SECTION 07 90 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Interior joint sealers
B. Exterior joint sealers

1.03 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years experience.
B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.06 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.07 GUARANTY

A. The Contractor shall guaranty the sealant installation for a period of 5 years against defects in installed materials and workmanship including a 5 year watertight warranty. Correct any sealant that is found to be defective, improperly installed or leaks within a 5 year period at no cost to the Owner.
PART 2 - PRODUCTS

2.01 SEALANTS

A. Silicon Exterior Joint Sealant: Silicon; ASTM C920, Type S, Grade NS, Class 50, Uses NT, M, G, A and O; single component.
   1. Color: Color as selected to match adjacent material, selected from manufacturer's full range of available colors.
   2. Product: Dow Corning 790 or 795 Silicone Building Sealant, Sonneborn Building Products, Vulkem, Sikaflex or approved
   3. Applications: Use for:
      a. Joints between window frames and concrete – (match frame color).
      b. Joints between door and louver frames or concrete.
      c. Exposed joints in prefinished metal panels

B. Polyurethane Exterior Joint Sealant: Polyurethane; ASTM C920, Type S, Grade NS, Class 25, Uses NT, M, G, A and O.
   1. Color: Color as selected to match adjacent material, selected from manufacturer's full range of available colors.
   2. Product: Dynatrol I XL single component or Dynatrol II two component (as required to achieve required color) manufactured by Pecora, Sonneborn Building Products, Vulkem, Sikaflex or approved.
   3. Applications: Use for:
      a. Sealant for sheet metal flashing installation/joints.
      b. Exterior locations requiring painted finish over sealant.
      c. Other exterior joints for which no other sealant is indicated.

C. Exterior Metal Lap Joint Sealant: Butyl rubber, nondrying, nonskinning, noncuring.
   1. Product: BC-158 Butyl Rubber Sealant manufactured by Pecora, Sonneborn Building Products, Vulkem, Sikaflex or approved.
   2. Applications: Use for:
      a. Concealed sealant bead in lap joints for sheet metal work.
      b. Concealed sealant bead in lap joints in prefinished wall and roof panels
      c. Sealant for bedding door thresholds.
      d. Do not use in any location exposed to view or exposed to the sun.

D. General Purpose Interior Sealant: Siliconized acrylic emulsion latex; ASTM C834, single component, paintable.
   1. Product: AC-20+Silicone manufactured by Pecora or similar by Tremco, Sonneborn Building Products, Bostix Chem-Calk or approved.
   2. Color: Match color of adjacent materials; or as selected by Architect.
   3. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between interior door/relite frame and wall surfaces.
      c. Joints between interior side of window frames and wall surfaces.
      d. Between GWB and other materials.
      e. Joints between counter backsplash and wall.
f. Other interior joints for which no other type of sealant is indicated.

E. Plumbing Fixture/Tile Sealant: Neutral-curing silicone; ASTM C920, Class 50; single component, mildew resistant.
   1. Product: 898 Sanitary Mildew Resistant Silicone Sealant manufactured by Pecora, Dow Corning or approved.
   2. Color: Match color of plumbing fixture or adjacent materials as approved by Architect.
   3. Applications: Use for:
      a. Joints between plumbing fixtures and counter, floor and wall surfaces.
      b. Interior joints in stone and ceramic tile or between tile and adjacent materials.

F. Foam Sealant: Pre-formed, self-expanding foam sealant with pressure sensitive adhesive, supplied in pre-compressed rolls.
   1. Product: Emseal Backerseal (Greyflex); size as recommended by manufacturer to accommodate joint size.
   2. Install as a concealed secondary seal on interior side of doors frames, window frames and louver frames to stop air and moisture intrusion.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit substrate and application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant of type recommended by sealant manufacturer for type of sealant; ASTM D1667, oversized as recommended by sealant manufacturer.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate work sequence and installation with work of other trades to provide a weathertight installation at exterior applications.
3.02 EXAMINATION

A. Inspect the substrate surfaces and joint openings and confirm they are ready to receive sealant work.

B. Confirm that joint size, configuration and conditions conform to sealant manufacturer's requirements so as to achieve manufacturer's published sealant performance.

C. Verify that joint backing and release tapes are recommended for use by sealant manufacturer with the specified sealant.

D. Do not start sealant installation until substrate surfaces and joint openings conform to sealant manufacturer's requirements.

E. Start of sealant installation indicates installer's acceptance and confirmation that substrate, joint openings and conditions are in conformance with sealant manufacturer's requirements.

3.03 PREPARATION

A. Thoroughly clean and prepare joint substrate surfaces in accordance with sealant manufacturer's instructions to achieve published sealant performance.

B. Remove loose materials and foreign matter which might impair adhesion of sealant.

C. Clean and prime joint bonding surfaces in accordance with manufacturer's instructions.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.04 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions to achieve published sealant performance.

B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.
3.05 CLEANING
   A. Clean adjacent soiled surfaces.

3.06 PROTECTION OF FINISHED WORK
   A. Protect sealants until cured.

END OF SECTION
SECTION 08 11 00
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Interior Hollow Metal Doors And Frames
B. Exterior Hollow Metal Doors And Frames
C. Hollow Metal Relite, Sidelite And Borrowed Lite Frames

1.03 REFERENCES

A. All references shall be the latest adopted edition (except where edition date is specifically noted).
C. ANSI/SDI A250.6 – Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
D. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
G. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.


K. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

L. ASTM D3359 – Standard Test Methods For Measuring Adhesion By Tape Test

M. DHI A115.1G - Installation Guide for Doors and Hardware; Door and Hardware Institute.


O. SDI 111-D – Door, Frame And Hardware Schedule For Standard Steel Doors And Frames.

P. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Provide manufacturer's product literature and standard details.
   1. Provide manufacturer's technical data sheet on each different type of anchor and hardware reinforcement required.

C. Shop Drawings: Provide elevation and details of each different frame and door type, including frame anchors, glass stops, vision panels, and special conditions.

D. Door Schedule: Provide door, frame, and hardware schedule on format matching SDI 111-D in accordance with Door Schedule included on Drawings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all products from a single manufacturer who is a member of the Steel Door Institute.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect products from moisture, construction traffic, and damage.

B. Store vertically under cover. Do not use non-vented plastic or canvas shelters. Should wrappers become wet, remove immediately.
C. Place units on 4 inch high wood sills or in a manner that will prevent rust or damage. Provide 1/4 inch space between doors to promote air circulation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Member of Steel Door Institute with products conforming to these specifications. Acceptable manufacturers include:
   1. Ceco Corporation
   2. Republic Builders Products
   3. Steelcraft Manufacturing Company
   4. Substitutions: See Section 01 60 00 Product Requirements

B. Steel Sheet for Doors and Frames:

C. Steel Sheet for Anchors and Accessories: Electrolytically deposited zinc coated steel; ASTM A679, coating 40Z (12G), minimum.

D. Grout/Mortar Fill:
   1. Exterior Frames, Frames In Masonry walls, and Frames at overhead doors: mortar used for brick veneer specified in Section 04 21 13; or grout complying with ASTM C 476, or non-corrosive, pre-mixed pourable grout with minimum 3,000 psi compressive strength.
   2. Interior Frames: Spray Foam.

2.02 HOLLOW METAL (HM) DOORS AND FRAMES

A. Frames: ANSI/SDI A250.8 Level 3 is the minimum performance standard; provide the following special requirements that exceed this minimum standard:
   1. Regular Use Frames: 16 gauge steel sheet, fabricated to size, profile and configuration shown on Drawings.
   2. All Exterior Door Frames: 14 gauge steel sheet, fabricated to size, profile and configuration shown on Drawings.
   3. Corner Construction: Face weld corners, grind welds flush and smooth.
   4. Provide temporary removable spreader bars on bottom of each frame.
   5. Reinforcement For Hardware: Conform to ANSI/SDI A250.6 and the following special requirements:
      a. Hinge Reinforcement: Provide 7 gauge hinge reinforcement in doors, full width of frame (lesser gauge with equivalent threads is not acceptable). Weld reinforcement securely to frame.
      b. Floor Anchors: Provide 14 gauge floor anchors on all frames, full width of frame, securely welded to foot of each frame leg, with 2 holes in each anchor for attachment to floor.
      c. Closer: Provide reinforcement sleeve full width of frame, formed to match frame profile.
6. Holes For Silencers: Drill stops to receive rubber silencers on frames not scheduled for weatherstripping or smoke gasket.

7. Glazed Lights in Frames: Provide rolled steel channel shape glazing stops prepared for countersunk oval head screws and butted corners.


9. Frames In Concrete/Masonry Walls: Coat interior surfaces of frame with waterproof, shop-applied fibrated asphalt mastic 1/6 inch thick.
   a. Provide grout guards at hardware locations.

B. Doors: ANSI/SDI A250.8 Level 2 – Heavy-Duty, Model 2 – Seamless is the minimum performance standard; provide the following special requirements that exceed this minimum standard:

1. Regular Use Doors: 18 gauge sheet steel, fabricated to size and configuration shown on Drawings.


3. Door Construction:
   a. Face: Full flush, no seams.
   b. Edge Seam: Seamless, continuous welded and ground smooth.
   c. Edge Bevel: Bevel strike side.
   d. Hinge Cutouts: Provide handed hinge cutouts for door swing (non-handed doors with hinge fillers are not allowed).
   e. Edge Reinforcement Channels: Provide doors with full height 14 gauge steel lock channels (rails) and 12 gauge steel hinge channels (rails) concealed in construction of door and securely welded to both faces.

4. Door Core:
   b. Exterior Doors: Insulated core with U-value of at least 0.60 when tested in accordance with SDI 113.

5. Exterior Door Tops: Invert reinforcement channel to prevent place for water to collect and seal the top of door watertight.

6. Door Undercuts: Provide undercuts to accommodate door hardware provided by Section 08 71 00 and as required by applicable codes.

7. Door Vision Panels Frames: Fabricated steel frame with mitered corners designed to securely hold glazing and meet fire door requirements, prime painted, countersunk oval head screws.


2.03 FABRICATION

A. Confirm field conditions and coordinate depth of each frame throat to match thickness of wall or other configuration shown on Drawings.

B. Fabricate steel doors and frames to sizes and profiles shown on the Drawings in conformance to the requirements of this Section, ANSI/SDI A250.6, ANSI/SDI A250.8 and fire listing requirements.

C. Prepare and reinforce steel doors and frames to receive door hardware specified in Section 08 71 00.
D. Finish:

1. Factory Prime Paint Finish: Prime paint all surfaces of doors and frames under controlled conditions at the factory.
   a. Doors and frames shall be thoroughly cleaned, and chemically treated to insure maximum paint adhesion.
   b. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on.
   c. The finish shall meet the requirements for acceptance stated in ANSI/SDI A250.10.

2. Shop Prime Paint Touch-Up: Repair any factory applied prime paint damaged by shipping or by shop modifications to doors/frames.
   a. Surface preparation, prime paint and application shall conform to factory finishing standards and be compatible with field painting specified in Section 09 90 00.
   b. The finish shall meet the requirements for acceptance stated in ANSI/SDI A250.10.

3. Performance Requirement: Primer bond to steel substrate shall pass adhesion field testing per ASTM D3359, Type A Cross Hatch.

2.04 DOOR AND FRAME CLEARANCES

A. Door and frame clearances shall conform to ANSI/SDI A250.8, 2.06.

2.05 SPRAY FOAM

A. Spray Foam: Single component polyurethane foam sealant which expands to take the shape of cracks and voids and permanently seals to substrate surfaces.
   2. Fire Performance:
      a. Flame Spread Index Per ASTM E84: 25 or less
      b. Smoke Developed Index Per ASTM E84: 450 or less
   3. Thermal Barrier: None required when tested in accordance with UL 1715.
   4. Manufacturer/Product: Dow Chemical Company “Great Stuff”
      a. Select the specific Great Stuff product and canister size to best fit the application and site conditions.
      b. Use the Great Stuff Pro Window & Door minimal expanding, low pressure spray foam to prevent displacement or deflection of frames.
   5. Installation: Use Dow foam dispensing guns for installing spray foam, do not install with the disposable plastic straw provided.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution
of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate the size and layout of reinforcement and preparation for door hardware with Section 08 71 00.

C. Coordinate installation of hollow metal door frames located in masonry walls prior to masonry wall construction so that frames are solid grouted with mortar as masonry wall is laid up.

D. Coordinate installation of glazing with Section 08 80 00.

3.02 EXAMINATION

A. Verify that substrate and project conditions are suitable before beginning installation of frames.

B. Correct unsatisfactory condition before proceeding with installation.

C. Start of installation indicates acceptance of substrate and conditions.

3.03 PREPARATION

A. Solid Grouted Frames:
   1. Install foam blockouts inside frames at surface mounted hardware locations to permit drilling and tapping for screw installation after frames are installed and grouted.
   2. Confirm that grout guards at hardware locations will not leak mortar; install tape over any guards with openings.
   3. Plug any holes in the steel framing where grout could leak through.

3.04 SOLID GROUTING FRAMES

A. Frames in Masonry walls, and Frames at overhead doors: Install frames prior to masonry wall construction and overhead door placement to allow solid grouting frames with mortar. Use consistency at time of placement that will completely fill space intended to receive grout. Grout frames as masonry walls are constructed.

B. Interior Frames: Fill with Spray Foam.

3.05 INSTALLATION

A. Install frames plumb, level, rigid, and in true alignment as recommended in ANSI/SDI 250.11, NFPA 80, DHI A115.1G and in accordance with fire labeling requirements on fire rated openings.

B. Secure floor anchors to floor with steel anchors/screw of size, length and type appropriate for permanently secure attachment to substrate material, 2 anchors per jamb anchor.
C. Screw jamb anchors securely to wall framing/structure using method recommended by manufacturer for permanently secure installation.

D. Exposed Jamb Anchor Screws: Grind head of screw flush with frame and fill with polyester patching/filling compound (body filler) and sand surface flush and smooth to conceal screw and dimple.

E. Coordinate installation of glazing, stops and vision panel frames by Section 08 80 00.

F. Install doors plumb and in true alignment and fasten to achieve the maximum operational effectiveness and appearance of the unit. Maintain clearances specified in ANSI/SDI 250.8.

3.06 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.

B. Clean and restore soiled surfaces. Remove scraps and debris, and leave site and a clean condition.

3.07 SCHEDULE – REFER TO DRAWINGS

END OF SECTION
SECTION 08 14 00

FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Flush Hardwood Veneer-Faced Solid Core Wood Doors

1.03 REFERENCES

A. All references shall be the latest adopted edition, except as noted.

B. ANSI/WDMA I.S.1-A – Architectural Flush Wood Doors (Window & Door Manufacturer’s Association)


D. AWI - Architectural Woodwork Quality Standards; Architectural Woodwork Institute


1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Submit manufacturer’s product literature, indicate door core materials and construction; veneer species, plastic laminate, type and characteristics. Submit manufacturer’s product data on metal vision panel frames.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, factory machining criteria, finishing system criteria, identify cutouts for glazing.

D. Door Schedule: Provide door, frame, and hardware schedule on format matching SDI 111-D in accordance with Door Schedule included on Drawings.
E. Samples – Hardwood Veneer: Submit two samples of each different type of hardwood veneer specified, 8 x 11 x 1/4 inch in size illustrating species, wood grain and finish system.

F. Test Report: Submit copy of test report from independent testing laboratory certifying the STC rating of the sound rated doors.

1.05 QUALITY ASSURANCE
A. Perform work in accordance with ANSI/WDMA I.S.1-A.
B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years of experience.

1.06 DELIVERY, STORAGE, AND PROTECTION
A. Accept doors on site in manufacturer's packaging. Inspect for damage.
B. Protect doors with individual resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer. Break seal on site to permit ventilation.

1.07 PROJECT CONDITIONS
A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 WARRANTY
A. Provide manufacturer's warranty for the following term:
   1. Interior Doors: Life of installation.
B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. LyndenDoor
B. Oregon Door
C. Vancouver Door (Puyallup)
D. VT Industries
E. Substitutions: Refer to Section 01 60 00 - Product Requirements.
2.02 FLUSH WOOD DOORS

A. Flush Wood Doors: Bonded Core 5 or 7 ply doors conforming to ANSI/WDMA I.S.1-A and the following:
   1. Grade: WDMA Premium Grade
   2. Duty Level: WDMA Extra Heavy Duty
   3. Stiles and rails bonded to core
   4. Core: Structural composite lumber core (engineered wood) or particleboard cores.
      a. Hardware Blocking – Particleboard Core: Provide solid wood blocking for hardware attachment (not required for structural composite lumber core).
   5. Stiles And Rails: 1 inch minimum thickness solid hardwood, finger-jointing not allowed; vertical edge species solid hardwood matching face veneer species.

B. Sound-Rated Doors (Where Noted On Drawings): STC-42 minimum Sound Transmission Class when tested in accordance with ASTM E90.

2.03 MATERIALS

A. Door Face Veneer: Hardwood veneer suitable for transparent finish:
   1. Hardwood Veneer Species: Maple
   2. Veneer Cut: Plain sliced.
   3. Leaf Matching: Book match veneer leafs, balance matched on width of door face.
   4. Double Door Matching: Pair matched.


2.04 FABRICATION

A. Fabricate doors in accordance with ANSI/WDMA I.S.1-A requirements.

B. Fabricate fire rated doors in accordance with fire testing agency requirements. Attach metal fire rating label to door.

C. Vertical Exposed Edge of Stiles - Solid Edge: Of same species as veneer facing.

D. Bond edge banding to cores.

E. Bevel strike edge of door.

F. Coordinate size of door and edge clearances with frames specified in Section 08 11 00 and hardware specified in Section 08 71 00 so that field planing door edges for proper fit is not required.
G. Factory machine doors for finish hardware specified in Section 08 71 00 in accordance with hardware requirements and dimensions. Do not machine for surface hardware.
   1. Coordinate for scheduled electrified lockset hardware.

H. Cut out openings for vision panel frames.

I. Door Undercuts: Provide undercuts to accommodate door hardware provided by Section 08 71 00 and as required by applicable codes.

J. Factory fit doors for frame opening dimensions.

K. Provide edge clearances in accordance with AWI 1300.

2.05 FACTORY FINISH

A. Transparent Finish: Factory finish doors in accordance with ANSI/WDMA I.S.1-A Premium Grade:
   1. Finish System: TR-6 Catalyzed Polyurethane, including reduced vinyl sealer washcoat (if required), washcoat, stain, vinyl sealer, sanding with 220 grit, first topcoat and second topcoat; satin finish. UV Curable Polyester or Urethane finish systems are also acceptable.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

3.02 EXAMINATION

A. Inspect frames and existing conditions before starting work.

B. Verify that frames, opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

D. Beginning of installation indicates acceptance of frame installation and conditions.

3.03 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and WDMA installation requirements.
1. Install fire-rated doors in accordance with NFPA 80 requirements and fire listing.

B. Gap between bottom of door and floor shall not exceed 5/8 inch on non-rated doors; on fire rated doors gap shall not exceed code and fire listing requirements.

C. Coordinate installation of doors with installation of frames specified in Section 08 11 00 and hardware specified in Section 08 71 00.

D. Coordinate installation of glass and glazing.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE – Refer To Drawings

END OF SECTION
SECTION 08 36 00
OVERHEAD SECTIONAL DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 WORK INCLUDED

A. Overhead Sectional Steel Doors

1.03 REFERENCES

A. All references shall be the latest adopted edition.


1.04 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand dead loads and the positive and negative wind pressures as calculated in accordance with Section 1609 of the International Building Code, 85 mph basic wind speed, and as measured in accordance with ASTM E330 using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum load.

1.05 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Provide component construction, anchorage method, hardware, etc.

C. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, installation details.
D. Samples: Submit 2 color samples 4” x 6” in size of actual paint finish color selected on steel.

1.06 QUALITY ASSURANCE

A. Conform to the requirements of DASMA 102, conform to the requirements of this specification where they exceed DASMA 102.

B. Installer: Company specializing in performing the work of this section with minimum 5 years of experience.

PART 2 - PRODUCTS

2.01 MANUFACTURERS/PRODUCT

A. Manufacturers: Subject to their ability to provide products conforming with the requirements of this Section and shown on the Drawings, the following manufacturers may provide products:
   1. Overhead Door Corporation Series 592, Extra Heavy-Duty Thermacore, Insulated Sectional Steel Doors
   2. Substitutions: Refer to provisions in Section 01 60 00, Product Requirements.

2.02 OVERHEAD SECTIONAL STEEL DOOR COMPONENTS

A. Insulated Steel Door Panels: Conform to the following:
   1. Door Panels: Flush face smooth surface roll-formed hot dip galvanized steel exterior, no less than 0.016”, with foamed-in-place polyurethane insulation to form a metal/foam/metal sandwich, panel, thickness 2” inches, and EPDM rubber thermal break to prevent heat or cold conductivity. Insulation shall be free of CFC’s and will be fully encapsulated in non-permeable materials to prevent loss of thermal efficiency over time. The insulation will have an R-value of 17.5, U-value of .057 based upon calculated test data. The ship-lap design shall have rounded water channels.
   2. Exterior Surface: Flush and smooth.
   4. Interior Steel Face: 26 gauge sheet steel.
   5. End Stiles: 16 gauge, hot-dipped galvanized with thermal break.
   6. Vision Panels: Full view tempered insulated glass, partial glazed as shown, with “champagne” anodized aluminum sash sections at vision panels.
   7. Springs: Manufacturer’s higher cycle, minimum 50,000 cycles, as recommended for design requirements.
8. Hardware:
   b. Ball-bearing Rollers: Full-floating with hardened steel races, sizes adequate for design requirements and limitations. Long stem rollers at the top and bottom of door locations.

B. Operation: Provide auto opener doors with open, stop, close functions with electric sensing edge. Pneumatic is not acceptable. Provide low voltage wiring to door operator and sensing edge.

D. Finish and Color: Factory prime painted standard two-coat baked on polyester. Interior and Exterior Color: White. Track: 3 inch rolled galvanized steel, high lift clearance track configuration mounted as high as structure will permit to provide maximum clear height possible beneath door and track. with heavy duty compression spring at rear of track. Provide additional galvanized steel reinforcement as required to prevent movement or sagging of track during door operation. Provide galvanized steel track support angles and braces securely fastened to building structural member.

E. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers in case-hardened steel races, full floating, located at top and bottom of each panel, each side. Provide case-hardened steel roller wheels to suit size of track. Long stem rollers at the top and bottom of door locations.

F. Counterbalance Mechanism: Provide counterbalance mechanism consisting of the following: Cross Shaft Assembly: Adjustable, oil-tempered, helical wound steel springs mounted on a case hardened steel shaft and connected to the door with galvanized steel aircraft cable with a minimum safety factor of 8 to 1. Provide torsion springs capable of 75,000 high cycles minimum. Provide cast iron or aluminum cable drums, grooved to receive cable.

G. Door Safety Stops: At the bottom of the door provide a spring-loaded door safety device that automatically engages and will stop the door if a cable breaks. At the upper end of each door track provide a 36" rear compression bumper to stop door at end of travel.

H. Operation: RSX-with brake, side mount, 1/2 HP, 115volt commercial operator. Provide with safety bottom fixtures and w/ 2 wire bottom sensing edge full width of door. Provide reflector photo eyes with reversing edge. Operator: Provide with limit switches and relays with Dry Form 'C' contacts for interface with lights, heaters, fans and other misc. equipment for sequence of control. Operation: Provide auto opener doors with open, stop, close functions with electric sensing edge. Pneumatic is not acceptable. Provide low voltage wiring to door operator and sensing edge. Coordinate low voltage wiring with Mechanical and Electrical Sections.

I. Provide chain hoist backup on all doors. Note: chain hoist will not operate while
auto operator is in use

J. Weatherstripping:
1. Head And Jambs: Flexible PVC to seal door perimeter.
2. Bottom: EPDM rubber bulb type strip.
3. Panel Joints: EPDM rubber tube seals fitted inside every joint.

K. Lock: Locking device/mechanism designed to receive master-keyed cylinder lock provided by Section 08 71 00.

L. Provide all accessories, mounting brackets, fasteners, etc. for a complete and properly functioning unit meeting the requirements of this section.

M. Provide (2) radio controlled hand held transmitters for each door opening with an auto-opener. Provide each opener with a co-axial cable connected to an exterior mounted co-axial antenna. (1) per each opening typical.

PART 3 – EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

3.02 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Start of door installation indicates installer acceptance of wall opening and conditions.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer’s installation instructions.

B. Anchor door assembly securely to building structural framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks and braces to structural members only.

D. Fit and align door assembly including hardware.
E. Coordinate installation of master-keyed cylinder lock by Section 08 71 00.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.

B. Maximum Variation from Level: 1/16 inch.

C. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation.

B. Adjust door assembly for full contact with weatherstripping.

3.06 CLEANING AND PROTECTION

A. Clean doors, frames.

B. Remove temporary labels and visible markings.

C. Protect door from damage by construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION
SECTION 08 41 13
ALUMINUM STOREFRONT AND ENTRANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Aluminum Framed Entrance And Storefront Systems

1.03 REFERENCES

A. All references shall be the latest adopted edition (except where edition date is specifically noted).

B. AAMA 607.1 - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum

C. ASTM A36 - Standard Specification for Carbon Structural Steel


G. ASTM C864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers

H. ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen


J. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows,

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Provide manufacturer’s data on frames, doors and hardware.

C. Shop Drawings:
   1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes.
   2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of experience.

B. Installer Qualifications: Company specializing in the installation of products specified in this section on projects of similar scope and complexity, with not less than five years of documented experience. Upon request, provided listing of all projects completed within the last two years along names and contact information of general contractors and building owner representative for each project.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect finished surfaces as necessary to prevent damage.

B. Do not use adhesive papers or sprayed coatings which become firmly bonded when exposed to sun.

C. Do not leave coating residue on any surfaces.

D. Replace damaged units.

1.07 WARRANTY

A. Contractor shall warranty installed storefront system and windows for a period of 5 years to be watertight and free of leaks, free from defective materials, defective workmanship, glass breakage due to defective design, and shall replace any components that fails or is found to be defective upon notification by the Owner. Warranty shall cover the following:
   1. Complete watertight and airtight system installation within specified tolerances.
2. Completed installation will remain free from rattles, wind whistles and noise due to thermal movement and wind pressure.
3. System is structurally sound and free from distortion.
4. Glass and glazing gaskets will not break or "pop" from frames due to design, wind load pressure, expansion or contraction movement or structural loading.
5. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

B. Thermal Break Structural Integrity Warranty: Provide 10 Year manufacturer’s warranty against failure resulting from longitudinal or transverse shrinkage, cracking or loss of adhesion or prescribed pressure on the glazed material.

PART 2 - PRODUCTS

2.01 ALUMINUM STOREFRONT AND ENTRANCE DOORS

A. Installed Storefront System Performance Requirements:
   1. Air Infiltration: Not exceeding 0.06 CFM per square foot of fixed area when tested at differential static pressure of 6.24 P.S.F. in accordance with ASTM E283.
   2. Water Infiltration: No water penetration at 10 P.S.F. when tested in accordance with ASTM E331.
   3. Structural Performance: When subjected to the maximum design wind load pressures as defined for this project location by the IBC and State/local building codes and confirmed by tests in accordance with ASTM E330, storefront system shall:
      a. Limit deflection of framing members to not more than 1/200 or full recovery flexure limit of glazing if less.
      b. Provide a 50% safety factor on all fasteners attaching system to building structure.
   4. Thermal Performance: Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees Fahrenheit without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects. Doors shall function normally within these temperature differentials.

B. Manufacturer: Aluminum storefront specified herein is manufactured by Kawneer and is the standard of quality and function required for this project. Subject to their ability to provide products conforming with the requirements of this Section and shown on the Drawings, the following manufacturers may provide products: US Aluminum OR Arcadia. No other Substitutions.

C. Materials:
   1. Extruded Aluminum: Alloy 6063-T5 conforming to ASTM B221.
   2. Internal Reinforcing: ASTM A36 for carbon steel; or ASTM B308 for
structural aluminum, shapes and sizes to suit installation.
a. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.
3. Fasteners: Stainless steel, type recommended by storefront manufacturer for substrate conditions/materials.
5. Shims: Hard plastic, horseshoe shaped, available in different thicknesses as required.
6. Insulating Glass Units: Provide as specified in Section 08 8000.
7. Glazing Gaskets: E.P.D.M. elastomer extrusion conforming to ASTM C509 or C864; profile and hardness as required to maintain uniform pressure for watertight seal, black color.
8. Glazing: 1 inch sealed insulating glass units specified in Section 08 80 00.
10. Baffles (at weep holes): Type as recommended by system manufacturer and shown in published installation instructions.

D. Aluminum Storefront System: Extruded aluminum framing system complete with all related connections and anchorages. Provide all components required for a complete and functional installation conforming to manufacturer’s published performance requirements:
1. Framing Members: Kawneer Tri-Fab II 451 (2” x 4-1/2”) Thermal Exterior Glazed system, provide all framing members and accessories required for a complete and functional system that is leak free, in addition to the standard framing members provide the following special members:
a. Subsill: assembly continuous in one piece with subsill end closures sealed watertight.
b. Head Compensating Channel: assembly continuous in one piece.
c. Jamb Filler: rigid vinyl filler continuous in one piece (no joints) installed at back side of all jamb members to allow adequate depth for sealant and rod installation at storefront perimeter.
d. Provide stops at door frames, with brush weatherstripping.

E. Aluminum Doors: Kawneer, Tuffline500 Series heavy duty entrance doors and frames.
1. Side Rails: 5” wide.
4. Provide security astragal on each pair of doors.

F. Hardware:
1. Weatherstripping:
a. Single Acting Offset Pivot or Butt Hung Door and Frame (Single or
pairs): Thermoplastic elastomer weathering on a shape with a semi-rigid polymeric backing.
b. Equip meeting stiles on pairs of doors with and adjustable astragal utilizing wool pile.

2. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to interior exposed surface of bottom rail with concealed fasteners.

3. Threshold: Extruded aluminum, one-piece per door opening, ribbed surface, maximum 1/2 inch.


5. Push: CPII, 1 inch diameter radius push bar, clear anodized.

6. Pull: Style CO-9, 1 inch diameter radius pull, clear anodized.


8. Dead Latch: Standard Adams-Rite MS deadbolt with flush bolts on pairs of doors. See Section 08 71 00 for cylinder.

2.02 FABRICATION

A. Take accurate field measurements to verify required dimensions prior to fabrication.

B. Fabricate components in accordance with approved shop drawings and manufacturer’s fabrication instructions.

1. Remove burrs and smooth edges.

2. Shop fabricate to greatest extent practicable to minimize field cutting, splicing and assembly.

3. Disassemble only to extent necessary for shipping and handling limitations.

C. Fabricate components true to detail and free from defects impairing appearance, strength or durability.

D. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weathertight. Ensure slip joints make full, tight contact and are weathertight.

E. Maintain accurate relation of planes and angles, with hairline fit of contacting members.

F. Cut, reinforce, drill and tap doors and frames to receive door hardware specified herein and in Section 08 71 00; use concealed fasteners wherever possible.

G. Reinforce components as required at anchorage and support points, at joints, and at attachment points for interfacing work.

H. Provide structural reinforcing within framing members where required to maintain rigidity and accommodate design loads.
I. Install end dams in sill and subsill members to contain water within sill and prevent any leaks into building interior.

J. Provide weep holes or slots, deflector plates, internal flashings, and sealants to accommodate internal weepage draining water to the exterior and prevent any leaks to building interior.

K. Provide tight fitting, injection molded, plastic water deflectors at all intermediate horizontals.

L. Allow for adequate clearance around perimeter of system to enable proper installation and for thermal movement within system.

M. Separate dissimilar metals with protective coating or pre-formed separators to prevent contact and corrosion.

N. Doors: Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.

2.03 FINISHES

A. Anodized Finish: Color anodic coating, Architectural Class I, etched, medium matte, 0.7 mil minimum thickness; conform to AA-M12C22A44 and AAMA 608.1.

1. Color as indicated on the Drawings.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

3.02 EXAMINATION

A. Verify that openings are ready to receive work and dimensions are as indicated on shop drawings. Do not start installation until openings and conditions are acceptable.

B. Start of installation indicates installer’s acceptance of openings and site conditions.

3.03 INSTALLATION

A. Install storefront system in accordance with manufacturer's instructions, attach frame securely to building structure as recommended by manufacturer and required to resist dead and live loads.

1. Storefront system shall be installed so as to provide a completely
weathertight and leak-free barrier between interior and exterior of building.

B. Subsills: Seal fasteners and end dams watertight after installing subsill.

C. Install doors and hardware in accordance with manufacturer's printed instructions.

D. Align assemblies plumb and level, free of warp or twist, aligning with adjacent Work.

E. Install fasteners, anchors and shims to permanently fasten framing members securely to building structure in accordance with storefront manufacturer’s attachment instructions and fastener manufacturer’s installation instructions.
   1. Seal each fastener head/penetration permanently watertight with sealant.

F. Anchor securely in place, allowing for required movement, including expansion and contraction.

G. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with protective coating or pre-formed separators to prevent contact and electrolytic action.

H. Set and seal internal members and connections with internal sealants and baffles as called for in manufacturer’s installation instructions.

I. Glazing: Install glazing, setting blocks, spacer shims, edge blocking and glazing gaskets specified in Section 08 80 00 and this Section in accordance with storefront manufacturer's installation instructions without exception, including surface preparations.
   1. Utilize "anti-walk" edge blocking on all vertical edges of glazing.

J. Installation shall be completely watertight upon completion.

K. Erection Tolerances:
   1. Limit variations from plumb and level:
      a. 1/8 inch in 10 feet vertically.
      b. 1/8 inch in 20 feet horizontally.
   2. Limit variations from theoretical locations: 1/4 inch for any member at any location.
   3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.
   4. In no case shall any tolerances listed result in any door touching the frame or not opening/closing properly.
3.04 INSTALLATION – SEALANT TO ADJACENT CONSTRUCTION

A. Install primary sealant joint sealing exterior side perimeter of window frame to adjacent construction as shown on manufacturer’s installation instructions and as specified in Section 07 90 00.

B. Install secondary sealant joint sealing interior side of window frame perimeter to adjacent construction.

3.05 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer’s instructions to ensure smooth operation.

3.06 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.07 PROTECTION

A. Protect completed storefront installation from construction related damage and abuse.

END OF SECTION
SECTION 08 71 00
FINISH HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES

Hardware for swinging, sliding, and folding doors except special types of unique and non-matching hardware specified in other sections.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Manufacturers named in Part 2 of this section with not less than 5 years experience in manufacturing commercial door hardware of the type indicated.
   2. Hardware Supplier:
      a. A recognized architectural finish hardware supplier who has been furnishing hardware 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 Architectural Hardware Consultant (AHC), certified by the Door and Hardware Institute (DHI), who is physically available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor. Mail or telephone correspondence is not acceptable.
      c. Hardware supplier shall have local warehousing facilities and shall maintain an adequate parts inventory of items supplied for future service to the owner. Supplier will be a factory authorized distributor of all hardware specified.
   3. Installer: Company specializing in installing work of this section with not less than 3 years experience and acceptable to the manufacturer and the hardware supplier. The hardware installer shall meet with the representative of the hardware supplier to jointly inventory all hardware items. Upon satisfactory inventory of products, the hardware installer accepts responsibility for all hardware items inventoried.

B. Regulatory Requirements:
   1. Provide hardware for openings, whether specified or not, in compliance with NFPA Standard No. 80, IBC 2009 and local building code requirements. Provide only hardware which has been tested and listed by UL or WHI for types and sizes of doors required and complies with requirements of door and door frame labels.
2. Provide hardware which meets or exceeds handicap accessibility per local building code requirements. Conform to the Americans with Disabilities Act (ADA) of 1990.

1.04 SUBMITTALS

A. Under provisions of Section 01340, submit the following:
   1. Product information: Manufacturer's published technical product data for all specified door hardware items indicating compliance with the requirements.
   2. Hardware Schedule:
      a. Hardware schedules are intended for the Contractor's coordination of the work. Review and acceptance by the Architect or Owner does not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.
      b. Submit hardware schedule in the manner and format as suggested by the Door and Hardware Institute (DHI) complying with the actual construction progress schedule requirements for each draft.
   3. Templates: Hardware supplier will furnish hardware templates to the Contractor for each fabricator of doors, frames, and other work to be shop prepared or factory prepared for the installation of hardware.
   4. Warranty: Provide the manufacturer's standard warranty for each product, not to be less than one year after acceptance of the building by the owner. Door closers shall not be warranted for less than ten years.

PART 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

A. General:
   1. Provide all door hardware for complete work, in accordance with the drawings and as specified herein.
   2. Quantities listed, in any instance, are for the Contractor's convenience only and are not guaranteed.
   3. Provide items and quantities not specifically mentioned to ensure a proper and complete operational installation. Match the quality and finish of items specified.
   4. Provide miscellaneous hardware as listed in hardware groups.

2.2 HINGES

A. Manufacturer:
   1. Listed in Door Hardware Schedule: McKinney

B. Number of Hinges: Provide number of hinges indicated, but not less than 3 hinges per door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

2.3 PIVOTS AND PIVOT SETS

A. Manufacturer:
   1. Listed in Door Hardware Schedule: RIXSON
2.4 LOCKSETS, LATCHSETS, PRIVACY SETS AND CYLINDERS:

A. Mortise Locks - Manufacturer:
   1. Listed in Door Hardware Schedule: CORBIN-RUSSWIN
B. Cipher Locks – Manufacturer:
   1. Listed in Door Hardware Schedule: Simplex Unican
C. Lock Throw: Provide 3/4" minimum throw of mortise type latches and deadbolts used. Cylindrical latches will be 1/2" minimum. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

2.5 KEYS, KEYING, AND KEY CONTROL

A. Keys:
   1. Quantities: These quantities are to establish a maximum allowable quantity of cut keys to service the project and may not necessarily be assigned as noted. A lesser quantity of cut keys required will not result in any credits, nor a quantity of uncut keys to be issued unless noted otherwise.
      a. 3 change keys per each cylinder unit.
      b. 5 master keys per master.
      c. 10 construction keys.
   2. Deliver keys to the Owner's representative: Send masterkeys to Owner via U.S. registered mail direct from hardware supplier.

B. Keying:
   1. Comply with Owner's written instructions for masterkeying and, except as otherwise indicated, provide individual change keys for each lock which is not designated to be keyed alike with a group of related locks.

2.6 EXIT DEVICES AND MULLIONS

A. Manufacturer:
   1. Listed in Door Hardware Schedule: CORBIN/RUSSWIN
B. Provide risers, as needed, to prevent interference with door glazing kits.
C. Spacers as needed for proper application of removable mullions on narrow stop type frames shall be an integral part of the frame and supplied by the frame manufacturer.

2.6 CLOSERS:

A. Manufacturer:
   1. Listed in Door Hardware Schedule: NORTON
B. Provide parallel arms for all overhead closers, except as otherwise indicated. Provide drop plates as needed to prevent glazing interference.

2.7 PIPE STOPS/HOLDS

A. Manufacturer:
   1. Listed in Door Hardware Schedule: ABH

2.8 WALL AND FLOOR STOPS
A. Manufacturers:
   1. Listed in Door Hardware Schedule: TRIMCO

B. General: Except as otherwise indicated, provide stops (wall, floor or overhead) at each leaf of every swinging door leaf.

2.9 PROTECTION PLATES

A. Manufacturers:
   1. Listed in Door Hardware Schedule: TRIMCO

B. Sizes: Fabricate protection plates (armor, kick or mop) not more than 2" less than door width on stop side and not more than 1" less than door width on pull side, x the height indicated.

C. Metal Plates: Stainless Steel, 18 gauge (0.050) thick. Satin finish (US32D, 630), bevelled four edges (B4E).

2.10 GASKETS AND SWEEPS

A. Manufacturer:
   1. Listed in Door Hardware Schedule: PEMKO

B. General: Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf. Provide type, sizes and profiles indicated as drawn or scheduled.

2.11 THRESHOLDS

A. Manufacturer:
   1. Listed in Door Hardware Schedule: PEMKO

B. Where there is conflict between scheduled thresholds and details, details shall have precedence. Revise details only if necessary to comply with handicap accessibility requirements. Notify the Architect of such required modifications.

2.12 SILENCERS

A. Manufacturers:
   1. Listed in Door Hardware Schedule: TRIMCO

2.13 FINISHES

A. Exposed surfaces of hardware shall be Brushed Chrome (US26D, 626), unless otherwise indicated.

PART 3 EXECUTION

3.1 INSTALLATION
1. Install each hardware item in compliance with the manufacturer's instructions, requirements of NFPA 80, UBC, ADA, and Washington State Rules and Regulations for Barrier Free Facilities and recommendations of the DHI.

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

3. Where not factory machined, machine cut for hardware per template, as required.

3.2 ADJUSTING

A. Initial Adjustment:
   1. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit.
   2. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.3 HARDWARE SCHEDULE

Hardware Group #1 – Door #1, 16, 17

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ea. Pivot Sets</td>
<td>195 x ¾&quot; Offset 613</td>
</tr>
<tr>
<td>2 ea. Intermediate Pivots</td>
<td>M19 x ¾&quot; Offset 613</td>
</tr>
<tr>
<td>1 ea. Exit Device</td>
<td>ED4800 x 0855 613 CT6R</td>
</tr>
<tr>
<td>1 ea. Core</td>
<td>8000-6 613</td>
</tr>
<tr>
<td>1 ea. Exit Device</td>
<td>ED4800 613</td>
</tr>
<tr>
<td>2 ea. Pulls</td>
<td>1191-4N 613</td>
</tr>
<tr>
<td>2 ea. Closers</td>
<td>PR7500 x 6890 x 6891 x 7788 690</td>
</tr>
<tr>
<td>2 ea. Pipe Stops/Holds</td>
<td>1804 630</td>
</tr>
<tr>
<td>1 ea. Threshold</td>
<td>2748A</td>
</tr>
<tr>
<td>2 ea. Door Bottoms</td>
<td>29324DNB</td>
</tr>
<tr>
<td>1 ea. Weatherstrip</td>
<td>By Frame Mfg.</td>
</tr>
</tbody>
</table>

Hardware Group #2 – Door #2, 4

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 ea. Hinges</td>
<td>MPB79NRP 4.5 x 4.5</td>
</tr>
<tr>
<td>1 ea. Lockset</td>
<td>ML2051 LWA 630 CT6R</td>
</tr>
<tr>
<td>1 ea. Core</td>
<td>8000-6</td>
</tr>
<tr>
<td>1 ea. Wall Stop</td>
<td>1270 W 630</td>
</tr>
<tr>
<td>3 ea. Silencers</td>
<td>1229A</td>
</tr>
</tbody>
</table>
FINISH HARDWARE

Hardware Group #3 – Door #3

1 ea. Pivot Set 195 x ¾” Offset 613
1 ea. Intermediate Pivot M19 x ¾” Offset 613
1 ea. Push/Pull Set 1738LN 613
1 ea. Closer 7500 690
1 ea. Wall Stop 1270 W 613
1 ea. Jamb Seal By Frame Mfg.

Hardware Group #4 – Doors #5, 25

3 ea. Hinges MPB79NRP 4.5 x 4.5
1 ea. Privacy ML2030 LWA 630
1 ea. Kickplate K0050 10” x 2” LTDW B4E 630
1 ea. Mop Plate KM050 4” x 1” LTDW B4E 630
1 ea. Wall Stop 1270 W 630
3 ea. Silencers 1229A

Hardware Group #5 – Door #6

3 ea. Hinges MPB79NRP 4.5 x 4.5
1 ea. Lockset ML2055 LWA 630 CT6R
1 ea. Core 8000-6
1 ea. Closer 7500 689
1 ea. Kickplate K0050 10” x 2” LTDW B4E 630
1 ea. Wall Stop 1270 W 630
3 ea. Silencers 1229A

Hardware Group #6 – Door #7

3 ea. Hinges MPB79NRP 4.5 x 4.5
1 ea. Lockset ML2057 LWA 630 CT6R
1 ea. Core 8000-6
1 ea. Wall Stop 1270 W 630
3 ea. Silencers 1229A
Hardware Group #7 – Door #8, 30

3 ea. Hinges          MPB68NRP 4.5 x 4.5
1 ea. Lockset         ML2055 LWA 630 CT6R
1 ea. Core            8000-6
1 ea. Closer          PR7500 689
1 ea. Kickplate       K0050 10” x 2” LTDW B4E 630
1 ea. Wall Stop       1270 W 630
1 ea. Threshold       272A
1 ea. Door Bottom     315CN
1 ea. Weatherstrip    S88D

Hardware Group #8 – Door #10

3 ea. Hinges          MPB99NRP 4.5 x 4.5 US32D
1 ea. Cipher Lockset (Simplex) L1012C 626
1 ea. Core            8000-6
1 ea. Closer          7500 689 (Pull Side Mount)
1 ea. Kickplate       K0050 10” x 2” LTDW B4E 630
1 ea. Threshold       172A
1 ea. Door Bottom     315CN
1 ea. Weatherstrip    S88D
1 ea. Rain Drip       346C

Hardware Group #9 – Door #11, 12, 13, 14, 20, 21, 22, 23
All Hardware By Door Manufacturer.

Hardware Group #10 – Door #15, 24

3 ea. Hinges          MPB99NRP 4.5 x 4.5 US32D
1 ea. Cipher Lockset (Simplex) L1012C 626
1 ea. Core            8000-6
1 ea. Closer          PR7500 689 (Push Side Mount)
1 ea. Kickplate       K0050 10” x 2” LTDW B4E 630
1 ea. Threshold       172A
1 ea. Door Bottom     315CN
1 ea. Weatherstrip    S88D
1 ea. Rain Drip       346C
Hardware Group #11 – Door #18

3 ea. Hinges               MPB99NRP 4.5 x 4.5 US32D
1 ea. Lockset w/Deadbolt   ML2065 LWA 630 CT6R
1 ea. Core                 8000-6
1 ea. Closer               PR7500 689
1 ea. Kickplate            K0050 10” x 2” LTDW B4E 630
1 ea. Pipe Stop/Hold       1804 630
1 ea. Threshold            172A
1 ea. Door Bottom          315CN
1 ea. Weatherstrip         S88D
1 ea. Rain Drip            346C

Hardware Group #12 – Door #19

3 ea. Hinges               MPB99NRP 4.5 x 4.5 US32D
1 ea. Exit Device          ED5200 x TH957 630 CT6R
1 ea. Core                 8000-6
1 ea. Closer               PR7500 689
1 ea. Kickplate            K0050 10” x 2” LTDW B4E 630
1 ea. Pipe Stop/Hold       1804 630
1 ea. Threshold            272A
1 ea. Door Bottom          315CN
1 ea. Weatherstrip         S88D
1 ea. Rain Drip            346C

Hardware Group #13 – Door #26

3 ea. Hinges               MPB79NRP 4.5 x 4.5
1 ea. Latchset             ML2010 LWA 630
1 ea. Wall Stop            1270 W 630
3 ea. Silencers            1229A

Hardware Group #14 – Doors #9, 27, 28

Future Door – No Hardware Required in this phase of construction

Hardware Group #15 – Door #29

Door and Hardware to be provided by Owner. F.O.I.C.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Flat Glass
B. Insulating Glass Units
C. Glazing Accessories

1.03 REFERENCES

A. All reference shall be the latest adopted edition (except where edition date is specifically noted).


C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

D. ASTM C1036 - Standard Specification for Flat Glass

E. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass

F. ASTM C1193 - Standard Guide for Use of Joint Sealants

G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass

H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror

I. ASTM E773 - Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units
1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Provide manufacturer’s descriptive literature and performance data on each different type of glass and insulated glass unit specified.

C. Exterior Insulated Glass Unit Samples: Provide 12” x 12” sample of exterior insulated glass unit in specified type of glass.

D. Single Glazing Samples: Provide 4” x 6” samples of each different single glazing type specified.

1.05 PERFORMANCE REQUIREMENTS

A. Glass Thickness: Except where glass thickness is noted, select thickness of exterior glass to withstand dead loads and positive and negative live loads acting normal to plane of glass at design pressures calculated in accordance with requirements in the International Building Code and State/local codes.

1. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with "FGMA Glazing Manual" and "FGMA Sealant Manual" for glazing installation methods.

B. Fabricator, Sealed Insulating Glass Units: Minimum five years documented experience producing sealed insulating glass units specified in this section.

C. Installer Qualifications: Company specializing in the installation of products specified in this section on projects of similar scope and complexity, with not less than five years of documented experience. Upon request, provided listing of all projects completed within the last 2 years along names and contact information of general contractors and building owner representative for each project.
1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. Sealed insulating glass units shall be warranted for a period of ten (10) years against seal failure, interpane dusting or misting, and shall include removal of failed unit and replacement with new unit.

PART 2 - PRODUCTS

2.01 FLAT GLASS MATERIALS

A. Manufacturer
   1. Colored Glazing: Hartung Glass Industries or PPG Industries.
   2. Clear Glazing: Hartung Glass Industries or PPG Industries.
   3. Substitutions: See Section 01 60 00, Product Requirements

B. Clear Uncoated Float Glass:
   1. Clear heat-strengthened float glass complying with ASTM C1048, Type I transparent flat, Class 1 (clear), Quality Q3 (glazing select), Kind HS.
   2. Performance Values: Minimum 88 percent visible light transmission and a maximum solar heat gain coefficient of 0.82 (based on 1/4" thickness).

   1. Clear tempered float glass complying with ASTM C1048, Type 1 (transparent flat), Class 1 (clear), Quality q3 (glazing select), Kind HT.
   2. Fully heat temper glass to comply with CPSC 16 CFR 1201 and ANSI Z97.1 impact safety standards.
   3. Permanently etch one corner of each piece of tempered glazing indicating compliance with ANSI Z97.1, locate etch mark so it is visible after installation.

D. Low-Emissivity Coated Float Glass:
   1. Low-E, Colored “Bronze”

E. Low-Emissivity Coated Heat Tempered Safety Glass:
   1. Low-E, Colored “Bronze”

F. Clear tempered float glass complying with ASTM C1048, Type 1 (transparent flat), Class 1 (clear), Quality Q3 (glazing select), Kind HT; with pyrolytic coating
meeting the requirements of ASTM C1376.
1. Fully heat temper glass to comply with CPSC 16 CFR 1201 and ANSI Z97.1 impact safety standards.
2. Permanently etch one corner of each piece of tempered glazing indicating compliance with ANSI Z97.1, locate etch mark so it is visible after installation.

G. Mirror Safety Glass: Fully heat tempered with horizontal tempering.
1. Clear tempered float glass complying with ASTM C 1048, Type 1 (transparent flat), Class 1 (clear), Quality q3 (glazing select), Kind HT.
2. Fully heat temper glass to comply with CPSC 16 CFR 1201 and ANSI Z97.1 impact safety standards.
3. Permanently etch one corner of each piece of tempered glazing indicating compliance with ANSI Z97.1, locate etch mark so it is visible after installation.
4. Warranty: Manufacturer shall warrant silver mirror backing for 10 years against visible deterioration or failure.

2.02 GLAZING ACCESSORIES

A. Glazing Compound: Silicone sealant single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining; cured Shore A hardness of 15 to 25; color as selected.

B. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

C. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

D. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal.
1. Fire Rated Glazing: Glazing tape shall conform to fire listing requirements of the fire rated glazing.

E. Glazing Gaskets: Specified in Section 08 41 13.

2.03 FABRICATION

A. Heat-Strengthened Glass: Heat strengthen all glass that is not specified to be fully heat tempered.
1. Cut float glass materials to indicated sizes and provide cut-outs and holes, if indicated, before heat strengthening.
2. Heat strengthen float glass materials in accordance with ASTM C 1048, Kind HS

B. Heat-Tempered Glass:
1. Cut float glass materials to indicated sizes and provide cut-outs and holes, if indicated, before heat strengthening.
2. Fully temper float glass materials in accordance with ASTM C1048, Kind FT.
4. Permanently etch one corner of each piece of tempered glazing indicating compliance with ANSI Z97.1, locate etch mark so it is visible after installation.

C. Low-Emissivity Coated Glass: Fabricate using methods and equipment recommended by manufacturer; protect coating from damage.

D. Sealed Insulating Glass Units:
1. Fabricate units in accordance with ASTM E2190 with components and performance characteristics specified in Schedule paragraph at the end of this Section.
2. Components:
   a. Glass Type: As specified in Schedule paragraph at the end of this Section.
   b. Heat Treatment: As specified in Schedule paragraph at the end of this Section.
   c. Air Space: Hermetically sealed, dehydrated air filled.
   d. Performance Characteristics: As specified in Schedule paragraph at the end of this Section.
3. Provide unit edge seals meeting requirements of ASTM E773, with aluminum spacers having mitered corners, and silicone sealant for glass-to-spacer seals.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate the installation of glazing in steel frames and steel doors with Section 08 11 00.
3.02 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

C. Beginning of installation indicates acceptance of openings, substrate and conditions.

3.03 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

3.04 INSTALLATION – GENERAL


3.05 INSTALLATION - INTERIOR STEEL DOORS AND FRAMES - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops straight and true to line, do not project above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

G. Workmanship: Glazing tape shall not extend beyond edge of stop or be installed crooked or wavy; remove and reglaze.
3.06 INSTALLATION - ALUMINUM STOREFRONT  
   A. Glazing of aluminum storefront is specified in Section 08 41 13.

3.07 CLEANING  
   A. Remove glazing materials from finish surfaces.  
   B. Remove labels after Work is complete.  
   C. Clean glass and adjacent surfaces.

3.08 PROTECTION  
   A. Protect installed products until completion of project.  
   B. Repair or replace damaged products before Substantial Completion.

3.09 GLAZING TYPE SCHEDULE (REFER TO WINDOW SCHEDULE FOR LOCATIONS)  
   B. **GL-2**: Single pane of 1/4 inch thick Clear Float Glass.  
   C. **GL-3**: 1 inch insulating glass unit with Low-Emissivity Coated Heat Tempered Safety Glass exterior pane (with Low-E coating on the number 2 surface) and Clear Uncoated Heat Tempered Safety Glass interior pane.  
   D. **GL-4**: Single pane of 1/4 inch thick Mirror Safety Glass

END OF SECTION
SECTION 08 91 00

EXTERIOR LOUVERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES
A. Exterior Louvers

1.03 REFERENCES
A. All references shall be the latest adopted edition.
B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association
C. ASTM B221 – Aluminum-Alloy Extruded Bar, Rod, Wire, Shape and Tube

1.04 SUBMITTALS
A. Refer to Section 01 33 00 for submittal procedures.
B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
C. Shop Drawings For Wall Louvers: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
D. Samples: Submit two paint color samples 4” x 5” size of actual paint on metal for each different color required to allow confirmation of color match.
E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

PART 2 - PRODUCTS

2.01 WALL LOUVERS
A. Manufacturer/Product: Ruskin ELF375X Stationary Louver. The following manufacturers are acceptable subject to their ability to provide a louver with construction and performance characteristics equal or exceeding the Ruskin louver specified:
1. Airolite
2. American Warming and Ventilating
3. Construction Specialties, Inc.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Materials
1. Extruded Aluminum: Conform to ASTM B221.
2. Bird Screen: 3/4” x 0.051” expanded, flattened aluminum screen in a removable frame.
3. Accessories:
   a. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
   b. Frame: Standard.
   c. Mounting Clip Angles: Extruded aluminum clip angles on backside of louver for concealed mounting on interior side of louver to wall framing.
   d. Fasteners and Anchors: Galvanized steel.
   e. Sealant: Specified in Section 07 79 00.
   f. 

C. Fabrication:
1. Prior to fabrication, coordinate louver sizes to conform with Mechanical Design requirements for free area, velocity, static pressure drop and duct size requirements; louver shall not exceed free area velocity beyond point of water penetration.
2. Fabricate louver in conformance with AAMA 611 and AMCA certification requirements.
3. Factory Finish: Factory painted with 70% Kynar 500 or Hylar 5000 Fluoropolymer PVDF2 paint coating in accordance with AAMA 2605, custom color.
   a. Color: Match adjacent wall color.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate preparation of wall opening.

C. Coordinate installation with work by mechanical.

3.02 EXAMINATION

A. Verify that prepared openings are ready to receive work and opening dimensions are as indicated on shop drawings.
B. Verify that field measurements are as indicated on shop drawings.

3.03 INSTALLATION – WALL LOUVERS

A. Install louver assembly in accordance with manufacturer’s instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

3.04 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION
SECTION 09 29 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Interior Gypsum Board (GWB)
B. Water Resistant Panels (GWB-WR)
C. Tile Backer Board (TBB)
D. Finishing Gypsum Board

1.03 REFERENCES

A. All references shall be the latest adopted edition.

B. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board

D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

E. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

F. ASTM C1178 - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel


H. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing
I. ASTM C1396 – Standard Specification for Gypsum Board


K. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association

L. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Submit manufacturer’s product data for each proposed product sufficient to show compliance with each product specified.

C. Samples: Submit 6 inch long sample of each different corner metal and trim specified.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years of consecutive successful experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable codes and installation requirements for fire rated assemblies indicated on drawings.

1.07 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.
1.08 PROJECT CONDITIONS

A. Environmental Conditions: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

B. Ventilation: Provide controlled ventilation during joint finishing operations, to eliminate excessive moisture. Avoid drafts during hot, dry weather to prevent finishing materials from drying too quickly.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD MATERIALS (GWB)

A. Interior Gypsum Board (GWB): ASTM C1396; Type X, fire rated, UL or WH tested and listed; sizes to minimize joints in place; ends square cut.
   1. Thickness: 5/8 inch.
   2. Edges: Tapered.
   3. Length: Longest lengths possible for least number of butt joints.
   4. Radius/Curved Walls: Use any thickness gypsum board that will bend to the required radius.
      b. 1/4-inch thick board requires 3 layers.
      c. 3/8-inch thick board requires 2 layers.

B. Water Resistant Panels (GWB-WR):
   1. Manufacturer/Product: USG Fiberock Brand Aqua-Tough Interior Panels or approved.
   2. Thickness: 5/8-inch
   3. Edges: Tapered
   4. Size: Largest size practicable to minimize joints in place.
   5. Ends: Square cut

C. Tile Backer Board (TBB):
   1. Manufacturer/Product: G-P Gypsum DensShield Tile Backer or approved.
   2. Thickness: 5/8”
   3. Edges: Tapered
   4. Size: Largest size practicable to minimize joints in place.
   5. Ends: Square cut
2.02 ACCESSORIES

A. Acoustic Sealant: Non-hardening, non-skinnning, for use in conjunction with gypsum board; USG Sheetrock Acoustical Sealant or similar.

B. Outside Square Corners: Galvanized metal corner bead factory clad with paper tape; Beadex Microbead or approved.

C. Angled Corners: Beadex B1 Flex 100’ Tape-On Flexible Corner Bead, or approved.

D. J-Mold (Where GWB Abuts Dissimilar Material And Is Exposed To View): Galvanized metal J-shaped trim factory clad with paper; Beadex B9J Tape-On “J” Trim or approved.
   1. GWB Abuts Windows: Provide temporary heavy weight cardboard strip 3 inches wide between trim and face of window frame to protect frame from dirt and damage.

E. Control Joint: GA 216; roll-formed metal control joint with removable strip, similar to USG No. 93, or approved.

F. Joint Materials: Provide products by manufacturer of gypsum board. Conform to ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
   1. Interior Applications: Ready-mixed vinyl-based joint compound
      a. Taping Compound: Type specifically formulated for embedding tape and accessories and for pre-filling.
      b. Topping Compound: Type specifically formulated for finishing drywall over taping compound.
      c. Joint Tape: Manufacturer's standard paper reinforcing tape.
   2. Water Resistant Panels: Sheetrock Brand Durabond Setting-Type Joint Compound or Sheetrock Brand Easy Sand Joint Compound manufactured by U.S. Gypsum.
   3. Tile Backer Board (With Tile Finish):
      b. Joint Tape (Glass Fiber Mesh): Specified in Section 09 30 00.

G. Primer/Surfacer: Sheetrock Brand Primer-Surfacers Tuff-Hide manufactured by U.S. Gypsum.


I. Screws:
1. Interior Application: Conform to ASTM C1002; bugle-head steel, self-drilling type, black phosphate finish.
2. Exterior Application and Tile Backer Board: Conform to ASTM C1002; bugle-head steel, self-drilling type, provide with yellow zinc corrosion resistant coating.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate location of framing and backing for supporting ends of GWB and control joints with Section 06 10 00.

C. Inspect finished surfaces with Section 09 90 00 painting applicator and project superintendent, mark areas that require additional finishing.

3.02 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

B. Confirm that the framing is straight, is within specified tolerances and meets minimum allowable deflection requirements.

C. Confirm that utility rough-in fits properly within framing width and will not prevent GWB from fitting tight to face of framing members.

D. Confirm that there is adequate temporary heat and light.

E. Beginning of installation indicates acceptance of framing and conditions.

3.03 FLOOR PROTECTION

A. Protect concrete floors from contact with GWB dust, taping mud and primer/surfacer using heavy paper or other method.

3.04 GYPSUM BOARD INSTALLATION

A. Install GWB in conformance with ASTM C840, C1280, GA-216, and manufacturer's installation instructions.
1. Install in longest lengths possible for minimum number of joints.
2. Install to minimize butt end joints, especially in highly visible locations.
3. Comply with the installation requirements of fire rated assemblies listed
5. Tile Backer Board: Use corrosion resistant screws, locate cut edges at top of walls only, screw spacing as recommended by manufacturer.
6. Install shaftwall in conformance with manufacturer’s installation instructions and fire listing requirements.
7. Exterior Gypsum (GWB) Sheathing Board: Use corrosive resistant screws. Fit joints tight as recommended by manufacturer.

B. Install full width panels with cut pieces only at top of wall (no "belly bands").

C. Place wrapped edges adjacent to one another; do not place cut edges or butt ends adjacent to wrapped edges.

D. Maintain 1/4 inch maximum gap between bottom of gypsum board and floor.

E. Double-Layer Installation: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Place second layer parallel to first layer. Offset joints of second layer from joints of first layer.

F. Acoustic Sealant: Install at perimeter of all sound walls in accordance with manufacturer's instructions and as follows:
   1. Place continuous bead at perimeter of each layer of gypsum board.
   2. Seal around all penetrations by conduit, pipe, ducts, rough-in boxes, and at other similar penetrations.

G. Run gypsum board full depth behind steel door and relight frames.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Corner Beads: Install at external corners in a single full length piece free of butt joints, using longest practical lengths, no short pieces; place into a solid bed of soft joint compound for secure installation.
   1. Align bead straight and plumb.
   2. Align juncture with other corner bead flush.

B. J-Shaped Edge Trim: Install at any exposed to view location where gypsum board abuts any dissimilar material or ends with exposed edge (around window frames, exposed structure, etc.).
   1. Install heavy cardboard continuous at window perimeter to protect frame from dirt and damage.

C. Control Joints: Place control joints consistent with lines of building spaces and as follows:
   1. As determined by installer to avoid cracking in finished surfaces, generally not more than 30 feet apart on walls and ceilings over 50 feet long. Location and layout subject to Architect's approval; review with
3.06 JOINT TREATMENT

A. Finish gypsum board (whether exposed to view or not) in accordance with GA-214 to the following minimum level of finish:
   1. Painted Finish Exposed To View: Level 4, substitute a coat of Primer/Surfacer (15 – 20 wet mil thickness) in lieu of skim coating with joint compound; sand surface of Primer-Surfacer smooth.
   2. Surfaces in Mechanical/Electrical and Storage Rooms: Level 4.
   3. Concealed from View with Thick Adhered Surface Finish (sheet vinyl or rubber base, plastic sheet wainscot, etc.): Level 3.
   4. Concealed from View without Surface Finish Above Suspended Lay-In Ceilings: Level 1.
   5. Concealed from View with Tile Finish: Joint treatment specified in Section 09 30 00.
   7. Exterior Gypsum Sheathing Board: No finish when joints are butted tight except as required to achieve required fire rating in accordance with fire test/listing.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.07 APPLICATION – PRIMER/SURFACER

A. Apply Primer/Surfacer to all surfaces exposed to view in accordance with manufacturer’s installation instructions and at recommended application rate to achieve GA-214 Level 4 appearance, free of visible tape joint lines after finish painting is completed.
   1. Spray-apply Primer/Surfacer to 15 - 20 mil wet film thickness applied in two separate passes at 90 degrees to each other for proper coverage.
   2. Sand surface of Primer/Sealer lightly after it has dried to eliminate any unwanted stipple pattern or texture.

B. After application of Primer/Sealer, carefully inspect walls and mark any defects in surface finish.
   1. Fill/sand defective areas in surface finish and recoat with primer/surfacer.

3.08 INSPECTION WITH PAINTER AND PROJECT SUPERINTENDENT

A. Coordinate an inspection walkthrough of all finished GWB surfaces with the painter and project superintendent; mark any defects in the surface finish.
   1. Fill/sand defective areas in surface finish and recoat with primer/surfacer.
3.09 TOLERANCES

A. Gap Between Bottom Of GWB and Floor: 1/4 inch Maximum.

B. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

C. Butt Joint Finishing: Not readily visible under the normal lighting conditions found for any given area/surface.

D. Finishing Tolerances: All exposed surfaces shall be smooth and free from visible ridges, waves, ripples, holes, defects, delamination, roughness, depressions, screw pops, etc. Taped joints shall not be visible after finish paint application.

3.10 CLEAN UP

A. Remove all excess gypsum board and finishing materials from the site.

B. Remove gypsum board scraps and dust from all concealed spaces including interior spaces of wall framing.

C. Remove gypsum dust, taping mud and primer/sealer completely from window frames, door frames, subfloor surfaces and any surface/material exposed to view.
   1. Subfloor cleanliness/condition shall conform to floor covering installation requirements.

3.11 WORKMANSHIP

A. Gypsum wallboard shall be installed and finished using the best workmanship, including the following:
   1. No damaged board or paper face.
   2. Ends centered on framing.
   3. GWB tucked full depth behind hollow metal door frames.
   4. Gap at bottom of GWB 1/4 inch or less.
   5. Cut-outs for outlets and devices cut neatly with saw or router.
   6. GWB fastened tight to face of studs to eliminate screw pops.
   7. Acoustic sealant consistently applied to all openings and perimeters.
   8. All screws that do not engage framing removed.
   9. Taped joints full bedded in taping compound and free of air pockets.
   10. Butt joints finished with minimal thickness and tapered out for flat appearance.
   11. Taped joints smooth and flat so as to disappear after painting.
   12. Paper face not roughened by sanding.
   13. Bottom of GWB behind rubber base and coved base properly finish smooth and free of roughness.
B. Gypsum wallboard installed and finished with improper or poor workmanship shall be removed and replaced at Contractor’s expense.

3.12 FIELD QUALITY CONTROL

A. Contractor Quality Control: Employ/assign quality control personnel to monitor the work of this section for conformance to the requirements of this section and to good construction practices.
   1. Contractor is solely responsible for managing and controlling the quality of the work and conformance with the requirements of this Section.

B. Schedule of Required Inspections by Contractor; confirm installation and workmanship are as shown/specified:
   1. Inspect framing for conformance to specified surface tolerances.
   2. Confirm that batt insulation and sound insulation are installed in the proper locations and conform to specification requirements.
   3. Inspect GWB installation.
   4. Inspect trim installation.
   5. Inspect taping and finish application.
   6. Inspect finish on bottom of walls with rubber base and coved base.
   7. Inspect finished GWB surfaces after primer is applied with painter and GWB finisher to identify any finishing defects requiring correction prior to painting.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Vinyl Composition Tile Flooring (LVT)
B. Resilient Base (VRB)

1.03 REFERENCES

A. All reference shall be the latest adopted edition.
B. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
D. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile
E. ASTM F1861 - Standard Specification for Resilient Wall Base

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.
B. Product Data: Submit manufacturer’s product data sheet for each of the following (subject to Owner approval during submittal review):
   1. Luxury Vinyl Composition Tile Flooring
   2. Resilient Base
   3. Adhesives for each different flooring product and accessory
   4. Cleaning Products
C. Samples: Submit 2 color samples of each color selected for each item specified.
1.05 DELIVERY, STORAGE AND PROTECTION
A. Protect roll materials from damage. Store materials in accordance with manufacturer’s instructions.

1.06 ENVIRONMENTAL REQUIREMENTS
A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
B. Maintain building temperature at 65 degrees F for 2 weeks minimum prior to installation.
C. Store materials for not less than 48 hours prior to installation in area of installation at a temperature above 65 degrees F to achieve temperature stability. After flooring has been installed, maintain conditions above 60 degrees F.

1.07 EXTRA MATERIALS
A. For each color/pattern of floor material, provide one box of floor tile for Owner’s maintenance use.

PART 2 - PRODUCTS

2.01 GENERAL
A. For substitutions, see Section 01 60 00, Product Requirements.

2.02 VINYL TILE - LUXURY VINYL TILE FLOORING (LVT)
A. See drawings for manufacturer of LVT flooring, colors and pattern.

2.03 MATERIALS – RESILIENT BASE
A. See drawings for manufacturer of resilient base and colors.

2.04 ACCESSORIES
A. Subfloor Filler: Cementitious latex type not adversely affected by moisture or alkali as recommended by flooring and adhesive materials manufacturer for application to concrete slab on grade; the following manufacturers/products are acceptable:
   1. Ardex K-15
   2. Mapei PRP110
B. Adhesives and Sealants: Use ONLY premium (best) quality low VOC adhesives and sealants approved by flooring/base/accessory manufacturer and Owner for each different type of flooring and substrate.
C. Primers: Low VOC primer recommended by flooring manufacturer for each different floor substrate and condition.

D. Transition/Reducer Strips: Rubber in color matching rubber base, profile required to accommodate flooring and condition, Johnsonite or approved.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate concrete floor finish and curing/drying requirements with Sections 03 30 01 and 03 30 02.

C. Schedule flooring installation to follow drying of concrete floor slab and completion of interior painting.

3.02 EXAMINATION

A. Verify that concrete sub-floor surfaces are ready for resilient flooring installation and within the limits recommended by resilient flooring manufacturer and adhesive materials manufacturer by testing the moisture emission rate, alkalinity and any other tests in manner recommended by manufacturers.

B. Verify that sub-floor surfaces are flat within tolerances specified in Section 03 30 01 using a 10 foot long straight edge.

C. Examine sub-floors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

D. Verify that wall surfaces are smooth and flat within tolerances specified in Section 09 29 00; are free of voids, openings or gaps; are dust-free, and are ready to receive resilient base.

E. Inspect sub-floors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; oil, grease and other foreign materials that might prevent adhesive bond.
   1. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

F. Verify that sub-floor surfaces are free of all construction dirt, gypsum dust, taping mud, paint, sand, etc.
G. Verify that required floor-mounted utilities (drains, electrical outlets, etc.) are in correct location and installed to proper height to flush out with flooring material.

H. Report conditions contrary to contract requirements that would prevent a proper installation. Do not start installation until substrate/sub-floor meets requirements of material and adhesive manufacturers.

I. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the sub-floor. Beginning of installation indicates acceptance of substrate/sub-floor and conditions as conforming to all requirements.

3.03 PREPARATION

A. Sub-floor surface shall be smooth and free of waviness, ridges, bumps, depression or other irregularities that will be visible after resilient flooring is laid.
   1. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Vacuum clean substrate thoroughly; sand and dirt particles trapped under floor tile will require replacement of flooring.

D. Apply primer if recommended by flooring material or adhesive manufacturers for product or substrate/subfloor conditions.

3.04 INSTALLATION –VINYL TILE (LUXURY VINYL TILE)

A. Install LVT in strict accordance with manufacturer's guaranteed installation instructions.
   1. Color and pattern of tile shall be as shown on the Drawings.

B. Install tile wall to wall before the installation of appliances, furniture, equipment, etc.
   1. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
   2. Extend flooring beneath moveable casework, appliances, equipment or any other non-permanent item.

C. All tiles shall be from the same manufacturer's production run/lot.

D. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions.
   1. Observe the recommended adhesive trowel notching, open times, and working times.

F. Set flooring in place with firmly butted joints to achieve a hairline joint.

G. Roll flooring with 100 lb. roller to attain full adhesion in strict conformance with manufacturer's instructions.

H. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

I. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

J. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated using adhesive recommended by manufacturer.

### 3.06 INSTALLATION – RESILIENT BASE

A. Install base in accordance with manufacturer's installation instructions to properly prepared substrate.

B. Install base in continuous, unbroken lengths with joints at inside corners only.

C. Miter or cope internal corners for tight, hairline joint; at external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.

D. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces
   1. Top of base shall fit tight to wall, free of open crack or lack of adhesion.

E. Scribe and fit to door frames and other interruptions.

F. Install base on casework toe spaces and exposed ends.

G. Install base behind removable casework, equipment or any other non-permanent item.

### 3.07 PROTECTION OF FINISHED WORK

A. Prohibit traffic on resilient flooring for 48 hours after installation.

B. Protect flooring from any marring or damage resulting from construction operations.
3.08 CLEANING AND SEALING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Vinyl Composition Tile Flooring: Strip, clean, and seal flooring products in accordance with manufacturer's instructions.
   1. Thoroughly strip and clean flooring with cold water stripper.
   2. Seal with 2 coats of flooring manufacturer’s recommended (semi-gloss) sealer/finish.

C. Cleaned and sealed flooring shall have consistent appearance and sheen, and be free of trapped dirt, stains, scuff marks, scratches or discoloration.

3.09 SCHEDULE (Refer To Drawings)

END OF SECTION
SECTION 09 90 00

PAINTS AND COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Surface preparation and field painting

1.03 REFERENCES

A. All references shall be the latest adopted edition.


C. SSPC – Steel Structures Painting Council, Steel Structures Painting Manual.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Provide product data on each different paint finishing product.

C. Paint Schedule: Provide schedule of all proposed paint products for the items to be painted in format matching the Schedule found in Part 3 of this Section.

D. Paint Draw Down Samples: Submit two painted samples, illustrating selected colors for each color and system selected. Submit on heavy paper card stock, 8 x 10 inch in size.
   1. Sheen Samples: Submit samples of different sheens for each color as directed by Architect for selection.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility: All paint products used for painting a given material/surface shall be manufactured by the same company.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years successful experience.
1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and or as required by manufacturer's instructions and/or MPI MANUAL.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Provide environmental conditions as required by paint manufacturer, MPI Manual and as follows:

1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer's written literature.

2. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer's written literature.

3. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 - PRODUCTS

2.01 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, select products complying with MPI standards from the following acceptable Manufacturers:

1. Paints:
   a. Benjamin Moore & Company
   b. Sherwin Williams
   c. Parker Paint / Comex Group
   d. Kelly Moore
   e. No Substitutions.

2. Stain/Oils/Waterborne Urethanes:
   a. Sikkens
   b. Benjamin Moore & Company
   c. Cabots
   d. Daly's
3. Paints/stains must be products which installer has used on other projects and are known to provide excellent performance including:
   - A soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
   - Good hiding characteristics.
   - Good flow and brushing properties.
   - Good mildew-resistance.
   - Capable of drying or curing free of streaks or sags.

B. Certain manufacturer's products may not provide adequate hiding ability with the number of coats specified. Contractor may be required to provide additional coats at no additional cost if products are selected that do not provide adequate hiding ability.

2.02 ACCESSORY MATERIALS

A. Putty: Conform to FS TT-P-791A(3), colored to match paint and stain finishes, as applicable.

B. Cementitious Filler: Nonshrink formulation, white Portland cement with fine silicate aggregate, zinc-oxide pigment, and reinforcing chemical binder as approved.

C. Spackling Compound: Standard gypsum board compound.

D. Unspecified materials such as turpentine, linseed oil, or mineral spirits shall be products of reputable manufacturers and as recommended by paint manufacturers.

E. Materials for Undercoats and Finish Coats: Ready mixed, and shall not be changed, except thinning of undercoats (when required), reinforcing, or coloring, all of which shall be performed in accordance with manufacturers' recommendations.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate selection of paint products to be applied over prime coats applied by others for compatibility and good adhesion.

C. Coordinate inspection of finish GWB surfaces with Section 09 29 00 prior to start
of any painting work; identify and mark any defective areas for correction.

D. Schedule work to follow completion of all dust/dirt producing work.

3.02 EXAMINATION

A. Verify that surfaces are clean and ready to receive paint as required by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application or performance.

C. Start of installation indicates acceptance of substrate, finish and conditions and responsibility for proper finish and appearance.

3.03 SURFACE PREPARATION

A. Conform to MPI Manual surface preparation recommendations, paint manufacturer's recommendations and the following for preparation of each different surface scheduled to be painted:

B. Substrate: Clean substrate surfaces thoroughly before applying any primer or paint following paint manufacturer’s cleaning recommendations; allow substrate to dry thoroughly before starting paint application.

C. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Marks: Seal with shellac those which may bleed through surface finishes.

E. Mildew: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Factory Primed/Painted Items to be Painted: Hand sand factory finished surfaces to provide proper tooth for good adhesion of finish coats.

G. Exterior Ferrous Steel: Prepare surfaces to be painted in strict conformance with paint manufacturer's surface preparation requirements.
   1. Minimum Preparation: SSPC-SP6 Commercial Blast Cleaning of all surfaces in strict conformance with SSPC Steel Structures Painting Manual requirements.
   2. Application of primer shall follow surface preparation immediately within the same day or surfaces will require repeating the preparation procedure.
   3. Surface preparation and prime painting shall be scheduled to coincide with warm, dry weather, minimum 60 degrees F and rising.
H. Exterior Galvanized Steel, Stainless Steel and Aluminum: Prepare surfaces to be painted in strict conformance with paint manufacturer's surface preparation requirements.
   1. Minimum Preparation: SSPC-SP1 Solvent Cleaning of all surfaces in strict conformance with SSPC Steel Structures Painting Manual requirements. Acid etch surface as specifically recommended by the paint manufacturer.
   2. Application of primer shall follow surface preparation immediately within the same day or surfaces will require repeating the preparation procedure.
   3. Surface preparation and prime painting shall be scheduled to coincide with warm, dry weather, minimum 60 degrees F and rising.

3.04 PROTECTION

A. Protect all finish surfaces, landscaping, adjacent property and elements surrounding the work of this Section from overspray, damage or disfiguration.

B. Maintain subfloor surfaces free from paint and spills using heavy paper or other method.

3.05 APPLICATION

A. Apply products in accordance with manufacturer's instructions and MPI Manual.

B. Apply sufficient wet film thickness to provide good hiding, do not thin product.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry.

E. Allow applied coats to dry completely before next coat is applied.

F. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

G. Vacuum clean surfaces of loose particles. Remove dust and particles just prior to applying next coat.

H. Gypsum Board & CMU Surfaces: After paint has been spray or roller applied to uniform wet film thickness, backroll entire surface in same direction to provide uniform texture, reflective value and appearance, free of roller marks or lines.

3.06 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Remove louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
B. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.07 CLEANING

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.08 SURFACES THAT REQUIRE PAINT FINISH

A. Paint all materials/surfaces described below under SCHEDULE - PAINT SYSTEMS.

B. Firestopping/smoke seal exposed to view.

C. Factory-finished items that require painting:
   1. Access panels/doors

D. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Mechanical grilles and louvers
   2. Paint exposed to view insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, and hangers, brackets, collars, supports, and related similar items to match background surfaces
   3. Paint shop-primed items.
   4. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
   5. Exposed Sprinkler Piping: Refer to Division 21

3.09 SCHEDULE - PAINT SYSTEMS (ALL WORK IS MPI PREMIUM GRADE)

A. All materials/surfaces scheduled hereinafter shall be painted in accordance with designated MPI Systems and Product requirements.
   1. Sheen on finish coats shall be as selected by Architect from manufacturer’s paint sheen samples.
   2. Use the same manufacturer for each coat specified for a given system, do not intermix different manufacturer’s products within the same paint system unless specifically approved by manufacturer(s) and products are known to be compatible for use together.
      a. Where primer is applied by others:
         1) Select paint system compatible with primer installed by others.
         2) Test compatibility and adhesion of proposed paint products over primer prior to application.
      b. Paint failure due to incompatibility between different manufacturer’s products are Contractor’s responsibility to correct.
A. Mechanical and Electrical:
   1. Exposed HVAC ducts, conduit and uncovered piping in finished spaces:
      Waterborne, 3 coats.
      (1) One coat galvanized primer.
      (2) Two coats acrylic enamel. (semi gloss)
   2. Pipe and duct covering: Waterborne, 4 coats.
      One coat drywall joint compound thinned with latex sealer to working consistency.
      (1) One coat PVA primer sealer.
      (2) Two coats acrylic latex. (eggshell)
   3. Inside of ducts, visible from finished space.
      (1) One coat galvanized metal primer.
      (1) One coat dull black paint.
   4. Miscellaneous:
      Finish registers, grilles, exposed conduit, electrical cabinets, and similar items to match adjacent surfaces.

B. Exterior:
   1. Galvanized metal: Solvent base, 3 coats.
      (1) One coat galvanized metal primer.
      (2) Two coats alkyd enamel. (Semi-gloss)
   2. Cedar trim: Acrylic Latex over Alkyd Wood Primer, 3 coats.
      (1) One coat alkyd wood primer.
      (2) Two coats acrylic enamel. (Semi-gloss or Satin/eggshell as noted).
   3. Cedar Wood T&G Soffitting and Exposed Glu Lam Beams and Wood Brackets:
      (2) Two coats semi transparent stain
   4. Cementitious Panels and Siding: Acrylic Latex
      (1) coat acrylic latex primer/sealer.
      (2) Two coats acrylic latex. (satin).

C. Interior:
   1. Gypsum board, typical: Waterborne, 4 coats.
      (1) One coat latex PVA primer sealer (apply before application of texture coat).
      (1) One coat latex primer (apply after application of texture coat).
      (2) Two coats acrylic enamel. (Finish eggshell)
   2. Exposed wood: Waterborne Polyurethane, 3 coats.
      (3) Three coats waterborne polyurethane. (satin)
   3. Hollow Metal Doors and Frames: Solvent base, 3 coats.
      (1) One coat rust-inhibitive primer.
      (2) Two coats alkyd enamel. (Semi-gloss)
      (1) One coat rust-inhibitive primer.
      (2) Two coats alkyd enamel. (Semi-gloss)
   5. Galvanized Metal: Solvent base, 3 coats.
      (1) One coat galvanized metal primer.
      (2) Two coats alkyd enamel. (Semi-gloss)
      (3) Three coats waterborne polyurethane. (satin)
   4. Concrete, Cast in Place Concrete: Waterborne, 3 coats:
(1) One coat acrylic concrete/masonry sealer
(2) Two coats acrylic latex. (eggshell)

10. Concrete Masonry Units: Waterborne, 3 coats:
(1) Once coat block filler
(2) Two coats acrylic latex. (eggshell)

END OF SECTION
SECTION 10 14 00
IDENTIFICATION DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SUBMITTALS
A. Product Data, Shop Drawings and Samples, and installation details.

1.03 QUALITY ASSURANCE
A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Garnett/AccuBraille, ADA Signs; Vomar Products, 100 Series; or approved; unframed acrylic plaques with 1/4 inch radius at corners. Letter style and color, and plaque color as selected from manufacturer's standards.

B. Provide interior signage in compliance with ADA/ANSI 117.1 standards and as scheduled.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Install signs in accordance with manufacturer's instructions and approved submittals. Install in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other Sections.

B. Restore damaged finishes. Clean and protect work from damage.
3.02 SCHEDULE

A. Restroom Doors post Barrier Free ADA signage as required.

B. Exterior Barrier Free Parking sign and pole sign as shown on the Drawings.

END OF SECTION
SECTION 10 28 00

TOILET AND MISCELLANEOUS ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES

A. Toilet and Miscellaneous Accessories

1.03 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Product Data: Provide manufacturer’s data on accessories describing size, finish, details of function, backing required and attachment methods.

PART 2 - PRODUCTS

2.01 TOILET AND MISCELLANEOUS ACCESSORIES

A. Products listed are made by Bobrick Washroom Equipment except as noted. These products are the standard of quality and function required for this project. All items of each type to be made by the same manufacturer. Products by the following manufacturers that meet or exceed this standard of quality and function are acceptable:

1. Parker
2. Bradley Corp.

B. Metal: Type 304 satin finish stainless steel, or polished chrome-plated brass.

C. Attachment Devices: Provide backing plates, brackets, and hardware required for a complete installation. Fastening shall be concealed and theft proof when available. Provide locks and furnish keys for standard lockable items.

D. Accessory Items:

1. Soap Dispensers: B-4112.
4. Seat Cover Dispenser: B-4221
5. Stainless Steel Grab Bars: B-6806 Series, sizes as shown.
E. Mirrors: 1/4” thick (tempered) polished plate or float glass, silver coated and electrolytically copper plated. Use concealed fasteners. Sizes as shown on drawings.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate location, layout and type of openings and backing in walls to receive accessories with Section 06 10 00.

3.02 EXAMINATION

A. Verify backing and installation conditions are correct before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. Start of installation indicates acceptance of backing and installation conditions.

3.03 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.04 INSTALLATION

A. Install accessories in accordance with manufacturer’s installation instructions in locations shown on the Drawings.

B. Install plumb and level, securely and rigidly anchored to structural framing member or solid backing.

C. Secure grab bars to framing members or solid backing securely so as to support 350 lbs. per support without distress or failure.

D. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.

END OF SECTION
SECTION 10 44 00
FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General Conditions and Supplementary Conditions and Division 0 and 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES
A. Fire Extinguisher Cabinets
B. Fire Extinguishers

1.03 REFERENCES
A. All references shall be the latest adopted edition.

1.04 SUBMITTALS
A. Refer to Section 01 33 00 for submittal procedures.
B. Product Data: Manufacturer's descriptive literature for specified products; indicate compliance to specified requirements.

PART 2 - PRODUCTS

2.02 MANUFACTURERS
A. Available Manufacturers: Subject to conformance with the requirements of this Section, manufacturers offering products that may be provided for this project include, but are not limited to, the following:
   1. J.L. Industries, Inc. (specified)
   2. Larsen's Manufacturing Company
   3. Potter-Roemer
   4. Substitutions: Refer to requirements in Section 01 60 00.
2.03 FIRE EXTINGUISHER CABINETS

   1. Cabinet: Cold-rolled steel with factory-applied baked primer coating.
      a. Provide maximum recessment allowed by depth of wall framing.
      b. Where Fire Extinguisher Cabinets can be mounted within wall framing this shall be the chosen method. Surface mounted must be approved by Architect/Owner.
   2. Door & Frame: Extruded aluminum, clear anodized finish.
      c. Glazing: Clear Acrylic
      d. Trim style: 1-1/2” square
   3. Door hardware:
      a. Continuous hinge, allowing 180-degree door swing.
      b. Chrome handle pull.
      c. Lock: J.L. Industries SAF-T-LOK
      a. Legend: "FIRE EXTINGUISHER".
      b. Lettering Color: Black, or as required by Authority Having Jurisdiction.
      c. Placement: Vertical, on hinge side of door glazing, place on interior side of glazing to be read from exterior side; comply with all requirements of authorities having jurisdiction.

B. Extinguisher Mounting Bracket: Plated steel bracket for mounting either on wall or in cabinet, with quick release metal retaining strap to hold extinguisher securely to bracket. Provide for all extinguishers.

2.04 FIRE EXTINGUISHERS

A. Fire Extinguishers: 2A10BC capacity.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate size and location of recessed openings in framed walls.

3.02 EXAMINATION

A. Verify that wall openings are correct size and in correct locations.
3.03 INSTALLATION

A. Install cabinets securely to wall framing in accordance with manufacturer's instructions and as required by local Code Authority.
   1. Install Extinguisher Mounting Bracket centered in cabinet (or on wall as noted on Drawings) for each fire extinguisher.

3.04 ADJUSTING

A. Immediately prior to project completion, ensure extinguishers (provided by others) are fully charged and bear tag recording date of charging and signature of verifying entity.

3.05 PROTECTION

A. Protect exposed finishes of cabinets from damage by subsequent construction activities

B. Repair minor damage to finishes in accordance with manufacturer's recommendations; replace components which cannot be repaired to Owner's satisfaction.

END OF SECTION
SECTION 12 20 00
WINDOW TREATMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 0 and Division 1 Specification Sections apply to work of this Section.

1.02 SECTION INCLUDES
A. Horizontal Louver Blinds

1.03 SUBMITTALS
A. Refer to Section 01 33 00 for submittal procedures.
B. Product Data: Submit manufacturer's product data for horizontal blinds.

1.04 QUALITY ASSURANCE
A. Fabricator: Company specializing in fabricating the products specified in this Section with minimum ten years experience.
B. Installer: Installer trained and certified by the manufacturer with minimum five years experience in installing products comparable to those specified in this Section.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials wrapped and crated in a manner to prevent damage and protect from dirt or staining. Mark packaging with location of installation using same name room designations indicated on the drawings.
B. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, or warping.

1.06 WARRANTY
A. Manufacturer’s standard limited lifetime warranty.
PART 2 - PRODUCTS

2.01 BLINDS

A. Manufacturers/Product:
   1. Levelor Mark 1 Cordless 1” Blind

B. Horizontal Blinds: 1” wide, adjustable tilt horizontal blinds.
   1. Conform to Federal Standard FS AA-V-00200, Type II.
   2. Color Selections: As specified in Section 01 8419
   2. Headrail: Manufacturer’s standard headrail consisting of channel shaped section complete with tilting mechanism, top and end braces, top cradles and accessory items required for type of blind and installation indicated. Finish to match slats.

C. Head Rail: Manufacturer’s standard heavy duty 1” x 1-1/2” steel head rail headrail consisting of channel shaped section complete with tilting mechanism, top and end braces, top cradles and accessory items required for type of blind and installation indicated. Finish to match slats.

D. Bottom Rail: Manufacturer’s standard tubular steel bottom rail, with closed ends same color as rail, finished to match slats.

E. Slats: 1” wide, manufacturer’s standard spring tempered aluminum slats, 0.008” thick, rounded corners with forming burrs removed.
   1. Support Ladders: Woven or braided polyester in color complementing slat color.

F. Tilting mechanism: Manufacturer’s standard assembly including disengaging worm and gear mechanism to eliminate overdrive, low friction gear tilter, drum and cradle at each ladder, tilt rod, cords designed to hold slats at any angle and prevent movement of slats due to vibration, with clear plastic adjusting wand of proper length for convenient operation.
   1. Locate tilt rod on left side of windows.
   2. High Windows: Provide extra length tilt adjustment wands to allow easy operation from floor level.

G. Lifting Mechanism: Manufacturer’s cordless mechanism.

H. Installation Brackets: Manufacturer’s standard brackets designed for securing blind to window head, match color of slats.

I. Finish: Polyester baked enamel finish, antimicrobial, anti-static.
   1. Colors: See Drawings for Colors.
PART 3 - EXECUTION

3.01 COORDINATION

   A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

   B. Schedule window treatment installation to follow installation of all other interior finishes.

3.02 EXAMINATION

   A. Verify that openings and installation conditions are ready to receive the work.

   B. Do not fabricate window treatments until field measurements are verified.

   C. Verify location of existing backing or supports.

   D. Clean surfaces thoroughly prior to installation.

   E. Beginning of installation means installer accepts existing surfaces and conditions.

3.03 INSTALLATION – HORIZONTAL BLINDS

   A. Install blinds at all windows in accordance with manufacturer’s installation instructions. Adjust for proper operation.

END OF SECTION
SECTION 12 32 00
FACTORY CASEWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Factory Plastic Laminate Casework
B. Plastic Laminate Countertops
C. Plastic Laminate wainscot

1.03 REFERENCES

A. All references shall be the latest adopted edition.
B. AHA A135.4 - Basic Hardboard; American Hardboard Association
C. ANSI A208.1 - Wood Particleboard
D. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association
E. PS 1 - Construction and Industrial Plywood
F. PS 20 - American Softwood Lumber Standard

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.
B. Product Data: Provide manufacturer’s data for casework, hardware and accessories.
C. Shop Drawings: Provide plan and elevation view of all casework; indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
1. Counter-Mounted Item (Sinks, appliances, etc.): Show location and size of cutouts for all counter-mounted items, including reinforcing and special requirements. Coordinate rough-in requirements and cut-out dimensions required to accommodate counter-mounted items with trade responsible.

2. Owner Provided Equipment/Appliances: Show location and size of all Owner provided equipment, including reinforcing and special requirements. Coordinate rough-in requirements and dimensions required to accommodate equipment/appliances with Owner.

3. Coordinate all required dimensions, cutout sizes and rough-in requirements with Owner or trade responsible prior to submission.

D. Samples:
1. Plastic Laminate: Submit two 8” x 11” samples of each different plastic laminate color selected.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AWI Quality Standards, Custom Grade, except where noted otherwise for specific elements of the work.

B. Work in this Section shall comply with the specified Grade found in the Architectural Woodwork Institute Quality Standards (AWI).

C. Woodwork Manufacturer/Fabricator: Company specializing in fabricating the products specified in this section with minimum five years of successful experience.

1.06 DELIVERY, STORAGE & PROTECTION

A. Protect units from moisture damage.

1.07 ENVIRONMENTAL REQUIREMENTS

A. During and after installation of work of this section, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

PART 2 - PRODUCTS

2.01 FABRICATION STANDARD

A. Fabrication Standard: AWI Section 1600 Modular Cabinets Custom Grade, Flush Overlay Design Standard Edging, High Pressure Decorative Laminate Finish; except where modified by this Section and the Drawings to meet the requirements of this project.
2.02 WOOD MATERIALS

A. Softwood Lumber (for use in concealed locations only): NIST PS 20; Graded in accordance with AWI P-200 Economy average moisture content of 11 percent.

2.03 PANEL MATERIALS

A. Softwood Plywood: NIST PS-1, APA stamped, exterior grade, five ply, sanded "A" face on exposed surfaces to receive finish material, "B" or "C" face on concealed surfaces, manufactured with a formaldehyde-free adhesive.

B. Melamine-Faced Monolithic Flakeboard (Particleboard): Industrial Grade Particleboard conforming to ANSI A208.1 manufactured with a formaldehyde-free binder, three-ply, balanced construction of 45 lbs. per cubic foot density, moisture content of 8% or less, with melamine laminate facing in colors noted on the Drawings.

C. Monolithic Flakeboard (Particleboard): Industrial Grade Particleboard conforming to ANSI A208.1 manufactured with a formaldehyde-free binder, three-ply, balanced construction of 45 lbs. per cubic foot density, moisture content of 8% or less.

D. Hardboard: AHA A135.4; pressed wood fiber, tempered grade, manufactured with a formaldehyde-free binder, exposed face(s) smooth.

E. Moisture Resistant Medium Density Fiberboard (MDF): Industrial Grade Medium Density Fiberboard (MDF), conforming to the requirements of ANSI A208.2-1994, product class MD-EXTERIOR.

2.04 PLASTIC LAMINATE MATERIALS

A. Manufacturers: Provide manufacturer's listed on the Drawings to achieve colors/patterns specified.

B. High Pressure Plastic Laminate conforming to NEMA LD 3 and the following:
   1. Vertical Applications: GP-33 (0.30 inch thick).
   2. Horizontal Applications: GP-50 (0.050 inch thick).
   3. Laminate Backing Sheet: BK20 (0.020 inch thick) backing grade, undecorated plastic laminate.
   4. Colors: Refer to Drawings.

2.05 HARDWARE & ACCESSORIES

A. Adhesive: Type recommended by laminate manufacturer to suit application.

B. PVC Edge Banding: .018” thick PVC edgebanding, hot melt glue applied at factory.
   1. Colors: Provide colors to match plastic laminate colors selected.
C. Hardware, General: Unless otherwise indicated, provide manufacturer’s standard satin-finish, commercial-quality, heavy-duty hardware.
   1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

D. Frameless Concealed Hinges (European Type): BHMA A156.9, Type B01602, self-closing.

E. Pulls: 4” solid stainless-steel wire pulls.

F. Door Catches: dual, self-aligning, permanent magnet catch.

G. Drawer Slides: BHMA A156.9, Type B05091
   1. Box Drawer Slides: Grade 1HD-100
   2. File Drawer Slides: Grade 1HD-2001
   3. Pencil Drawer Slides: Grade 2

H. Shelf Supports: Nickel plated steel L-shaped clips with steel pin which fits into 5 mm hole, with security pin for preventing inadvertent shelf removal.

I. Locks: National Lock, type appropriate for application, US26D satin chrome finish, keyed as directed.

J. Fasteners: Size and type to suit application.

K. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.

L. Concealed Joint Fasteners: Threaded steel.

M. Grommets: Plastic material for cut-outs. Colors: TBD.

N. Edge trim: brushed aluminum trim for top of wainscot sheets and inside corners.

2.06 MANUFACTURERS

A. The following are approved manufacturers. Substitutions allowed by request only, see Section 01 60 00 – Product Requirements.
   1. Westmark Products
   2. Custom Source Woodworking, Inc. - (360) 491-9365 7745 Arab Dr SE, Unit D, Olympia, WA 98501
   3. Higher Plane – 360-733-4322, contact: Dave Rossman, 1905 Division Street, Bellingham, WA 98226
   4. Interior Wood Products - 360-352-7273, contact: Brian Ritter, 9705 Lathrop Industrial Dr. SW Olympia, WA 98512
   5. RS Manufacturing – Mountlake Terrace, WA 425-774-1211
7. All Spaces, LLC – 360-873-8048, contact: Stuart Harr, 360-661-6117 mobile, 725 N. First Street Mount Vernon, WA 98273
8. Valley Cabinets & More, Inc. Mount Vernon, WA. 360-542-1276 contact: Marc Roberson shop@valleycabinets.com
9. Visser Cabinetworks, Inc. – 360-671-7270, 3965 Hammer Dr. Bellingham, WA 98226
10. WW Wells Millwork – Everett, WA 425-259-9155
12. Wollin Woodworking – 360-240-8403 Contact: Tyler Wollin 639 Industrial Ave., Unit C OakHarbor, WA 98277
13. Display Manufacturing L.L.C.
14. NW Custom Cabinets - (360) 757-8788 Contact: Derek Slotemaker Peterson Road Burlington, WA 98233

2.07 FABRICATION - PLASTIC LAMINATE FACED CASEWORK

A. Verify field conditions and dimensions prior to starting fabrication.

B. Fabricate casework to conform to manufacturer’s published standard and these specifications.

C. Fabricate in sizes and shapes indicated and as required to fit the spaces and conditions.

D. Provide thermo-fused melamine overlay on all exposed interior faces of particleboard that do not receive plastic laminate; color as selected.

E. Provide protective seal on concealed faces.

F. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

G. Cap exposed plastic laminate finish edges with PVC edge banding.

H. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

I. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.

J. Plastic Laminate Countertops: Substrate shall be plywood.

K. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces; match liner color where exposed inside of cabinet or on back of doors and drawer fronts.
L. Provide cutouts for fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

M. Base: Provide base heights as noted on Drawings.

N. Light Valance: Construct valance on upper cabinets wherever lighting fixtures are shown on Drawings.

PART 3 - EXECUTION

3.01 COORDINATION

A. Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

B. Coordinate backing requirements with Section 06 10 00.

C. Casework installation shall be scheduled to follow painting and installation of ceiling wall angle.

3.02 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.03 INSTALLATION – CASEWORK and WAINSCOT

A. Set and secure casework in place; rigid, plumb, and level in accordance with casework manufacturer’s installation requirements.

B. Field Joinery: Make joints neatly, with uniform appearance. Comply with requirements of AWI standard for shop joinery.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.

E. Secure cabinet and counter bases to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
G. Cutout back of cabinet and backsplash for each plumbing waste, water line and electrical box individually; make accurate cuts that will be covered completely by escutcheon trim and cover plates.

H. Cut cabinets to accommodate concealed ductwork neatly to fit size of duct; do not weaken cabinet or countertop support members.

I. Upper Cabinets inside Corners: Provide matching filler panels at top and bottom of upper cabinets at inside corners to eliminate void space.

J. Install wainscot to wall surfaces with adhesive(s) Low VOC as recommended by manufacturer. Securely fasten to wall. Install aluminum trim strip at top of panel and at corners typical.

3.04 WORKMANSHIP

A. Casework installation shall be installed using the best workmanship, including:
   1. No damage to exposed to view finished surfaces.
   2. Casework scribed tight to adjacent surfaces.
   3. Casework securely attached to wall framing/backing.
   5. Drawers open/close easily.
   6. Doors and drawers align properly.
   7. Door hinges not stiff or hard to open.
   8. Countertops properly supported and installed level and secured in place.
   9. Countertop joints tightly fitted and flush.
  10. Edges of plastic laminate not over or under-filed.
  11. No exposed fasteners.

3.05 ADJUSTING

A. Test installed work for rigidity and ability to support loads.

B. Adjust moving or operating parts to function smoothly and correctly.

3.06 CLEANING

A. Clean casework, counters, shelves, hardware, fittings and fixtures.

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.

B. Related Sections include the following:
   1. Division 23 Section “Common Work Results for HVAC” for submittal requirements and drawing requirements.

1.2 SUMMARY

A. This Section includes the following to complement other Division 22 Sections:
   1. Piping materials and installation instructions common to most piping systems.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Sleeves.
   5. Escutcheons.
   7. Plumbing demolition.
   8. Equipment installation requirements common to equipment sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to
outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 QUALITY ASSURANCE

A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Dielectric Unions:
   a. Capitol Manufacturing Co.
   c. Epco Sales Inc.
   d. Hart Industries International, Inc.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:
   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Epco Sales Inc.

3. Dielectric Couplings:
   a. Calpico, Inc.
   b. Lochinvar Corp.

4. Dielectric Nipples:
   a. Grinnell Corp.; Grinnell Supply Sales Co.
   b. Victaulic Co. of America.

5. Mechanical Sleeve Seals:
   a. Calpico, Inc.
   b. Metraflex Co.
   c. Thunderline/Link-Seal.
   d. Innerlynx
2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is 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 B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D2235.
   2. CPVC Piping: ASTM F493.
   3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
   4. PVC to ABS Piping Transition: ASTM D3138.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Composite. Include two for each sealing element.

D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated and rough brass.

C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated and rough brass.
2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.


2. Design Mix: 5000-psi, 28-day compressive strength.


2.9 Propane Gas Piping:

1. Above grade: Use schedule 40 black steel pipe with 150# malleable iron fittings. All concealed piping shall be welded.

2. Below Grade: Use schedule 40 black steel pipe with 150# malleable iron fittings. Coat the piping and fittings in accordance with Utility Company requirements. Provide cathodic protection as required.

3. Flexible Piping: Piping shall be corrugated stainless steel tubing flexible gas piping, with mechanical attachment fittings. UL listed, CSA approved, and FM listed for Flammable Gas Piping Systems. Tubing shall be 300 series stainless steel, ASTM A240, heat treated or annealed after the corrugation forming operation. Tubing suitable for natural gas and propane gas, rated at 5 psi. The tubing shall have an integral, black fire-retarded polyethylene sleeve, ASTM E84 flame spread rating not to exceed 25, ASTM E84 spoke density rating not to exceed 50. Sleeve shall be fitted, where required, with a plastic containment coupling and 1/4” NPT vent port, with vent through the roof. Vents through the roof shall be protected from rain with an approved vent cap. Pipe system shall be approved for use with natural gas and propane gas, both for installation within buildings and under buildings. Piping under buildings shall be installed without fittings or couplings.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation plus 1-inch clearance around insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.
L. 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.

M. Install escutcheons for penetrations of walls, ceilings, and floors.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

P. Verify final equipment locations for roughing-in.

Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.


F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
   2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
   3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   5. PVC Nonpressure Piping: Join according to ASTM D 2855.
   6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

L. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to 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 plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

3.6 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout around anchors.

F. Cure placed grout.

END OF SECTION 22 05 00
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.

B. Related Sections:
   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

B. Valve Sizes: Same as upstream piping unless otherwise indicated.

C. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
   1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

D. Valve-End Connections:
   1. Solder Joint: With sockets according to ASME B16.18.
   2. Threaded: With threads according to ASME B1.20.1.
2.2 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

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. American Valve, Inc.
   b. Apollo
   c. Conbraco Industries, Inc.; Apollo Valves.
   d. Jenkins
   e. NIBCO INC.
   f. Approved equal..

2. Description:

   b. CWP Rating: 400 psig.
   c. Body Design: One piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE or TFE.
   g. Stem: Bronze.
   h. Ball: Chrome-plated brass.
   i. Port: Reduced.

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

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. American Valve, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Crane Co.; Crane Valve Group; Crane Valves.
   d. Hammond Valve.
   e. Lance Valves; a division of Advanced Thermal Systems, Inc.
   f. Legend Valve.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Red-White Valve Corporation.
   j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   k. Approved Equal.

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 or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

C. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

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. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. DynaQuip Controls.
f. Hammond Valve.
g. Lance Valves; a division of Advanced Thermal Systems, Inc.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Approved equal.

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 or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

PART 3 - EXECUTION

3.1 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.

3.2 ADJUSTING
A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 VALVE MANUFACTURE
A. All ball valves shall be of one manufacturer.

END OF SECTION 22 05 23
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. PEX tube and fittings.
3. Piping joining materials.
4. Dielectric fittings.

B. Related Requirements:

1. Section 22 11 13 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

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.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type L.

B. Annealed-Temper Copper Tube: ASTM B88, Type L.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

G. Wrought Copper Unions: ASME B16.22.

H. Copper Tube, Pressure-Seal-Joint Fittings:

1. **Manufacturers:** Subject to compliance with requirements, provide products by the following:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   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.

3. Minimum 200-psig working-pressure rating at 250 deg F.

I. Copper Tube, Push-on-Joint Fittings:

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. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Elkhart Products Corporation.
   c. Mueller Industries, Inc.
   d. NIBCO INC.
   e. Victaulic Company.

2. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.


2.3 PEX TUBE AND FITTINGS

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. Uponor.
2. Viega LLC.
3. Zurn Industries, LLC.

B. **Tube Material:** PEX plastic according to ASTM F876.

C. **Fittings:** ASTM F1807, metal insert and copper crimp rings.

D. **Push-Fit Fittings:** ASSE 1061, push-fit fittings.
1. **Manufacturers:** Subject to compliance with requirements, provide products by the following:
   a. SharkBite, A Division of Reliance Worldwide Corporation.
   b. Zurn Industries, LLC.

   **E. Manifold:** Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F876; with plastic or corrosion-resistant-metal valve for each outlet.

2.4 **PIPING JOINING MATERIALS**

   **A. Pipe-Flange Gasket Materials:**
   
   1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
   2. Full-face or ring type unless otherwise indicated.

   **B. Metal, Pipe-Flange Bolts and Nuts:** ASME B18.2.1, carbon steel unless otherwise indicated.

   **C. Solder Filler Metals:** ASTM B32, lead-free alloys.

   **D. Flux:** ASTM B813, water flushable.

   **E. Brazing Filler Metals:** AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

   **F. Solvent Cements for Joining CPVC Piping and Tubing:** ASTM F493.

   **G. Solvent Cements for Joining PVC Piping:** ASTM D2564. Include primer according to ASTM F656.

   **H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts:** Type and material recommended by piping system manufacturer unless otherwise indicated.

2.5 **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.
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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. WATTS.
   b. Wilkins.
   c. Zurn Industries, LLC.

3. Pressure Rating: 125 psig minimum at 180 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

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. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed soldered joints.
2. Hard copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. PEX tube, NPS 1 and smaller.
   a. Fittings for PEX tube:
      1) ASTM F1807, metal insert and copper crimp rings.
      2) ASTM F1960, cold expansion fittings and reinforcing rings.
      3) ASSE 1061, push-fit fittings.
4. PVC; socket fittings; and solvent-cemented joints.

3.2 EARTHWORK

A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.
3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install valves according to the following:
   1. Section 22 05 23.12 "Ball Valves for Plumbing Piping."
   2. Section 22 05 23.13 "Butterfly Valves for Plumbing Piping."
   3. Section 22 05 23.14 "Check Valves for Plumbing Piping."
   4. Section 22 05 23.15 "Gate Valves for Plumbing Piping."

D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."

E. Install domestic water piping level and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

G. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. 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.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. 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.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.
O. Install PEX tubing with loop at each change of direction of more than 90 degrees.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 22 05 19 "Meters and Gages for Plumbing Piping."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.4 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 B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
H. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.

I. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.

J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

C. 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.

D. Install vinyl-coated hangers for PEX tubing, 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.

E. Support horizontal piping within 12 inches of each fitting.

F. Support vertical runs of copper to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 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.

3.7 IDENTIFICATION
A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.8 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.

3.9 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.

3.10 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.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 11 16
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Division 23 Section "Common Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
   2. Division 23 Section "General-Duty Valves for Mechanical Piping" for general-duty ball, butterfly, check, gate, and globe valves.
   3. Division 23 Section "Identification for Mechanical Piping and Equipment" for labeling and identifying requirements.
   4. Division 22 Section "Water Distribution Piping" for water-supply piping and connections.
   5. Division 23 Section "Hangers and Supports for Mechanical Piping and Equipment" for pipe hangers and seismic restraints.
   6. Division 26 sections for power-supply wiring, field installed disconnects, electrical devices, and motor controllers.

1.2 SUMMARY

A. This Section includes water distribution piping specialties for the following:
   1. Water distribution systems.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:


1.4 SUBMITTALS

A. Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:
1. Backflow preventers.
2. Water pressure regulators.
5. Thermostatic water mixing valves.
7. Strainers.
8. Trap seal primer valves.
10. Outlet boxes.
11. Washer supply outlets.
12. Miscellaneous water distribution piping specialties.

B. Reports: None required.

C. Maintenance Data: For specialties to include in the maintenance manuals specified in Division 01. Include the following:

1. Backflow preventers.
2. Trap seal primer valves.
3. Miscellaneous water distribution piping specialties.

1.5 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on water distribution piping specialties made to specified standards.

B. Listing and Labeling: Provide electrically operated water distribution piping specialties specified in this Section that are listed and labeled.
   1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

C. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.


E. Comply with Washington State Department of Health Publication 331-137 "Backflow Prevention Assemblies Approved for Installation in Washington State."

1.6 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
1. Operating Key Handles: Furnish one extra key for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Backflow Preventers:
   a. CMB Industries; Febco Div.
   b. Conbraco Industries, Inc.
   c. Zurn Industries, Inc.; Wilkins Div.

2. Balancing Valves:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Flow Design, Inc.
   d. ITT Fluid Technology Corp.; ITT Bell & Gossett Div.
   e. Taco, Inc.
   g. Watts Industries; Water Products Div.

3. Strainers:
   a. Ames Co., Inc.
   b. Cla-Val Co.
   c. CMB Industries; Febco Div.
   d. Conbraco Industries, Inc.
   e. FLOMATIC Corp.
   g. IMI Cash Valve.
   h. Watts Industries, Inc.; Water Products Div.
   i. Zurn Industries, Inc.; Wilkins Div.

4. Trap Seal Primer Valves:
   a. Josam Co.
   c. Precision Plumbing Products, Inc.
   d. Tyler Pipe; Wade Div.
   e. Zurn Industries, Inc.; Hydromechanics Div.

5. Trap Seal Primer Systems:
   a. Precision Plumbing Products, Inc., or approved equivalent.

6. Hydrants:
   a. Josam Co.
   c. Tyler Pipe; Wade Div.
   d. Zurn Industries, Inc.; Hydromechanics Div.

7. Miscellaneous Water Distribution Piping Specialties:
   b. Josam Co.
2.2 BACKFLOW PREVENTERS

A. General: ASSE standard, backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.
   1. Interior Components: Corrosion-resistant materials.
   2. Exterior Finish: Polished chrome-plate if used in chrome-plated piping system.

B. Reduced Pressure Backflow Assemblies (RPBA): ASSE 1013, suitable for continuous pressure application.
   1. 2-Inch NPS and Smaller:
      a. Bronze body with threaded ends.
      b. Full port ball valves on inlet and outlet, strainer on inlet, test cocks, and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.
      c. Pressure Loss: 15 psig maximum, through middle one-third of flow range.

C. Anti-siphon Pressure Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.
   1. Bronze body with threaded ends.
   2. Full port ball valves on inlet and outlet, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.
   3. Pressure Loss: 5 psig maximum, through middle one-third of flow range.

D. Hose Connection Vacuum Breakers: ASE 1011, brass body with non-removable and manual drain features, and ASME B1.20.7 garden-hose threads on outlet.

2.3 BALANCING VALVES

A. Circuit Balancing Valves: Adjustable, with 2 readout ports and memory setting indicator. Include manufacturer’s standard hoses, fittings, valves, differential pressure meter, and carrying case.
   1. 2-Inch NPS and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.

B. Memory-Stop Balancing Valves, 2-Inch NPS and Smaller: MSS SP-110, ball valve, rated for 400-psig minimum CWP. Include 2-piece, ASTM B 62 bronze body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, solder-joint ends, and vinyl-covered steel handle with memory-stop device.
2.4 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.
   1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
   2. 2-Inch NPS and Smaller: Bronze body, with female threaded ends.
   3. 2-1/2-Inch NPS and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved epoxy coating and flanged ends.
      a. Drain: Factory- or field-installed, hose-end drain valve.
   5. T-Pattern Strainers: Malleable-iron or ductile-iron body with grooved ends; access end cap with drain plug and access coupling with rubber gasket.
   6. Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.
      a. Simplex Type: Single unit, with one basket.
      b. Drain: Factory- or field-installed, hose-end drain valve.

B. Drainage Basket Strainers: Non-pressure-rated, cast-iron or coated-steel body; with bolted flange or clamp cover and drain with plug.
   1. Basket: Bronze or stainless steel with 1/8- or 3/16-inch- diameter holes and lift-out handle.
   2. Female threaded ends for 2-inch NPS and smaller, and flanged ends for 2-1/2-inch NPS and larger.

2.5 TRAP SEAL PRIMER VALVES

A. Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:
   1. 125-psig minimum working pressure.
   2. Bronze body with atmospheric-vented drain chamber.
   3. Inlet and Outlet Connections: 1/2-inch NPS threaded, union, or solder joint.
   4. Gravity Drain Outlet Connection: 1/2-inch NPS threaded or solder joint.
   5. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.6 HYDRANTS

A. Wall Hydrants: ASME A112.21.3M or ASSE 1019, nonfreeze, automatic draining, antibackflow type, key operation, with 3/4- or 1-inch NPS threaded or solder-joint inlet, and ASME B1.20.7 garden-hose threads on outlet. Include operating key for each hydrant.
   1. Type: Recessed.
2.7 MISCELLANEOUS WATER DISTRIBUTION PIPING SPECIALTIES

A. Water Hammer Arresters: ASME A112.26.1M, ASSE 1010, or PDI-WH 201, bellows or piston type with pressurized cushioning chamber. Sizes are based on water-supply fixture units, ASME A112.26.1M sizes A through F and PDI-WH 201 sizes A through F.

B. Hose Bibbs: Bronze body, with renewable composition disc, 1/2- or 3/4-inch NPS threaded or solder-joint inlet. Provide ASME B1.20.7 garden-hose threads on outlet and integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker.

PART 3 - EXECUTION

3.1 WATER DISTRIBUTION PIPING SPECIALTY INSTALLATION

A. General: Install water distribution piping specialty components, connections, and devices according to manufacturer's written instructions.

B. Install backflow preventers of type, size, and capacity indicated, at each water-supply connection to mechanical equipment and systems, and to other equipment and water systems as indicated. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment. Install air-gap fitting on units with atmospheric-vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.

C. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve, and where indicated.

D. Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of one percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

E. Fasten wall-hanging water distribution piping specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

F. Fasten recessed, wall-mounting water distribution piping specialties to reinforcement built into walls.

G. Secure supplies to supports or substrate.

H. Install individual stop valve in each water supply to water distribution piping specialties. Use ball, gate, or globe valve if specific valve is not indicated.

I. Install water-supply stop valves in accessible locations.
J. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

K. Include wood-blocking reinforcement for recessed and wall-mounting water distribution piping specialties.

L. Include access for trap primers.

M. Install hose bibbs with integral or field installed vacuum breaker.

N. Install wall hydrants with integral or field installed vacuum breaker.

O. Install water hammer arrestors near quick acting valves at the end of pipe runs and batteries of fixtures, including flush valves, washing machines, dishwashers, and as indicated. Provide access.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
   1. Install piping connections between water distribution piping specialties and piping specified in other Division 22 Sections.
   2. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
   3. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.

B. Install hoses between water distribution piping specialties and appliances as required for connections.

C. Arrange for electric-power connections to water distribution piping specialties and devices that require power. Electric power is specified in Division 26 Sections.

D. Supply Runouts to water distribution piping specialties: Install hot- and cold-water-supply piping of sizes indicated, but not smaller than required by authorities having jurisdiction.

E. Ground electric-powered water distribution piping specialties.  
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Arrange for electric-power connections to water distribution piping specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 26 Sections.
3.3 START-UP PROCEDURES

A. Before startup, perform the following checks:
   1. System tests are complete.
   2. Damaged and defective specialties and accessories have been replaced or repaired.
   3. Clear space is provided for servicing specialties.

B. Before operating systems, perform the following steps:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open general-duty valves to fully open position.
   3. Remove and clean strainers.
   4. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

C. Startup Procedures: Follow manufacturer's written instructions. If no procedures are prescribed by manufacturer, proceed as follows:
   1. Energize circuits for electrically operated units. Start and run units through complete sequence of operations.

3.4 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and train Owner's maintenance personnel as specified below:
   1. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing trap seal primer systems.
   2. Review data in the maintenance manuals. Refer to Division 01.
   3. Schedule training with Owner with at least 7 days' advance notice.

3.5 PROTECTION

A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 11 19
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.

B. Related Section:
   1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and IBC with state amendments.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Seismic Qualification Certificates: For waste and vent piping, 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. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

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. ANACO-Husky.
   c. Fernco Inc.
   d. Matco-Norca, Inc.
   e. MIFAB, Inc.
   f. Mission Rubber Company; a division of MCP Industries, Inc.
   g. Stant.
   h. Tyler Pipe.
   i. Approved equal.


3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

D. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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."

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.
   1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer 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."

E. Solvent Cement: ASTM D 2564.
   1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Solvent cement 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."

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
   1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
   2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   3. Unshielded, Nonpressure Transition Couplings:
      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:
2) Femco Inc.
3) Mission Rubber Company; a division of MCP Industries, Inc.
4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
5) Approved equal.

c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. Sleeve Materials:
   2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:
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:
   2) Mission Rubber Company; a division of MCP Industries, Inc.
   3) Approved equal.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING
A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION
A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on 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 at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 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.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Install aboveground ABS piping according to ASTM D 2661.
O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground ABS and PVC piping according to ASTM D 2321.

Q. Plumbing Specialties:
   1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
   2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
   3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION


B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. 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.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in OD's.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
   3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
   4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
   5. Vertical Piping: MSS Type 8 or Type 42, clamps.
   6. Install individual, straight, horizontal piping runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
   7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.

I. Install supports for vertical ABS and PVC piping every 48 inches.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves in pit with pit cover flush with floor.
6. Comply with requirements for backwater valves, cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION
   A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL
   A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
      1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

   B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

   C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

   D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
      1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
      2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
      3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
   3. Solid-wall or Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
   4. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, vent piping shall be any of the following:
   1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
   2. Solid-wall or Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
3. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
3. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 13 16
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Division 23 Section "Common Work Results for HVAC" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
   2. Division 23 Section "Identification for Mechanical Piping and Equipment" for labeling and identifying requirements.
   3. Division 22 Section "Drainage and Vent Piping" for drainage and vent piping and connections.
   4. Division 23 Section "Hangers and Supports for Mechanical Piping and Equipment" for pipe hangers and seismic restraints.
   5. Division 26 Sections for power-supply wiring, field installed disconnects, electrical devices, and motor controllers.

1.2 SUMMARY

A. This Section includes drainage piping specialties for the following:
   1. Soil, waste, and vent systems.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1.4 SUBMITTALS

A. Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:
   1. Cleanouts.
   2. Drains.
3. Miscellaneous drainage piping specialties.

B. Reports: Specified in "Field Quality Control" Article.

1.5 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

B. Listing and Labeling: Provide electrically operated plumbing specialties specified in this Section that are listed and labeled.
   1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

C. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.


1.6 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

   1. Water Filter Cartridges: Furnish quantity not less than 200 percent of amount of each type and size installed.
   2. Operating Key Handles: Furnish one extra key for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

   1. Cleanouts:
      a. Josam Co.
      c. Tyler Pipe; Wade Div.
      d. Zurn Industries, Inc.; Hydromechanics Div.

   2. Drains:
      a. Josam Co.
2.2 CLEANOUTS

A. General: Size cleanouts as indicated on drawings, or where not indicated, same size as connected drainage piping.
   1. Provide wall cleanouts on each end of water closet ends and one over main drops in addition, provide all cleanouts required per code.

B. Cleanouts: ASME A112.36.2M, cast-iron body with straight threads and gasket seal or tapered threads for plug, flashing flange and clamping ring, and a brass closure plug. Cleanouts for installation in floors not having membrane waterproofing may be furnished without clamping ring.
   1. Tiled Areas: Round cleanout top with tile recess top.
   2. Quarry Tiled Areas: Square nickel-bronze cleanout cover.
   3. Walls: Round cleanout cover with stainless steel finish.
   4. All Other Areas: Round cleanout top with nickel-bronze finish.

2.3 DRAINS

A. General: Size outlets as indicated on drawings.

B. Floor Drains: ASME A112.21.1M, cast-iron body, with seepage flange and clamping device, and trap seal primer valve connection. Floor drains for installation in floors not having membrane waterproofing may have seepage flange with clamping device. Floor drains for use as area drains in exterior slab on grade may be furnished with anchor flange instead of seepage flange and clamping device. Provide the following options as indicated:
   1. Trap primer connection.
   2. Round strainer with integral funnel.
   3. Polished nickel bronze top.
   4. Slotted top.

C. Trench Drains: Pre-sloped trench drainage system, polyethylene plastic drain channel with 0.75% bottom slope, modular sections with interlocking ends, standard cast grating, complete with the straps and mounting accessories.

D. Floor Sinks: Cast iron body, 12-inch square by 8-inch deep sump, 3-inch bottom outlet, square slotted medium duty grate, with polished nickel bronze top, with interior dome strainer.
2.4 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

B. Air-Gap Fittings: ASME A112.1.2, cast iron or cast bronze, with fixed air gap, inlet for drain pipe or tube, and threaded or spigot outlet.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4 lb/sq. ft. or 0.0625-inch thickness.
   2. Vent Pipe Flashing: 3 lb/sq. ft. or 0.0469-inch thickness.
   3. Burning: 6 lb/sq. ft. or 0.0937-inch thickness.

B. Copper Sheet: ASTM B 152, of the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Applications: 12 oz./sq. ft.
   2. Vent Pipe Flashing: 8 oz./sq. ft.

C. Zinc-Coated Steel Sheet: ASTM A 653, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.


E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 DRAINAGE PIPING SPECIALTY INSTALLATION

A. General: Install drainage piping specialty components, connections, and devices according to manufacturer’s written instructions.

B. Install cleanouts in aboveground piping and building drain piping as indicated, and where not indicated, according to the following:
1. Size same as drainage piping up to 4-inch NPS. Use 4-inch NPS for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping 4-inch NPS and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. Install cleanout deck plates, of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.

D. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

E. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

F. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

G. Install floor drains according to manufacturer's written instructions, in locations indicated.

H. Install floor drains at low points of surface areas to be drained as indicated. Set grates of drains flush with finished floor or as indicated. Size outlets as indicated.

I. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

J. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

K. Position floor drains for easy access and maintenance.

L. Fasten wall-hanging drainage piping specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

M. Fasten recessed, wall-mounting drainage piping specialties to reinforcement built into walls.

N. Install traps on drainage piping specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

O. Locate drainage piping as close as possible to bottom of floor slab supporting fixtures and drains.
P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

Q. Include wood-blocking reinforcement for recessed and wall-mounting drainage piping specialties.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
   1. Install piping connections between drainage piping specialties and piping specified in other Division 22 Sections.
   2. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.

B. Install hoses between drainage piping specialties and appliances as required for connections.

C. Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power is specified in Division 26 Sections.

D. Drainage Runouts to Drainage Piping Specialties: Install drainage and vent piping, with approved trap, of sizes indicated, but not smaller than required by authorities having jurisdiction.

E. Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 26 Sections.

3.3 FLASHING INSTALLATION

A. Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

B. Burn joints of lead sheets where required.

C. Solder joints of copper sheets where required.

D. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. **Embedded Specialty Flashing:** Flat sheet, with skirt or flange extending at least 8 inches around specialty.

E. Set flashing on floors and roofs in solid coating of bituminous cement.

F. Secure flashing into sleeve and specialty clamping ring or device.

G. Install flashing for piping passing through roofs with counterflushing or commercially made flashing fittings, according to Division 07.

H. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

I. Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

3.4 **FIELD QUALITY CONTROL**

A. Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.

1. Test and adjust drainage piping specialty controls and safeties. Replace damaged and malfunctioning controls and components.

3.5 **START-UP PROCEDURES**

A. Before startup, perform the following checks:

1. System tests are complete.
2. Damaged and defective specialties and accessories have been replaced or repaired.
3. Clear space is provided for servicing specialties.

B. Before operating systems, perform the following steps:

1. Close drain valves, hydrants, and hose bibbs.
2. Open general-duty valves to fully open position.
3. Remove and clean strainers.
4. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

C. Startup Procedures: Follow manufacturer's written instructions. If no procedures are prescribed by manufacturer, proceed as follows:

1. Energize circuits for electrically operated units. Start and run units through complete sequence of operations.
3.6 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and train Owner's maintenance personnel as specified below:
   1. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing interceptors.
   2. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing grease recovery units.
   3. Review data in the maintenance manuals. Refer to Division 01.
   4. Schedule training with Owner with at least 7 days' advance notice.

3.7 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19
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. Thermostat-control, electric, tankless, domestic-water heaters.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.
   1. Product Data: For energy efficiency.

B. Shop Drawings:
   1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: For commercial domestic-water heaters, 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.

B. Product Certificates: For each type of commercial and tankless, electric, domestic-water heater, from manufacturer.
C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1. Comply with efficiency requirements in ASHRAE 189.1, which supersede requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects," and NSF 372, "Drinking Water System Components - Lead Content."

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.
   a. Electric, Tankless, Domestic-Water Heaters: Five year(s).

PART 2 - PRODUCTS

2.1 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:

   1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Eemax Corporation or comparable products by one of the following:
      b. Chronomite Laboratories, Inc.
      c. E-Tankless Water Heaters Corp.
      d. Keltech, Inc.
      e. Niagara Industries, Inc.
      f. Approved alternate.

   2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.

   3. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
      b. Pressure Rating: 150 psig.
      c. Heating Element: Resistance heating system.
      d. Temperature Control: Thermostat.
      e. Safety Control: High-temperature-limit cutoff device or system.
      f. Jacket: Aluminum or steel with enameled finish or plastic.


   5. Capacity and Characteristics:
      1) See plans.

2.2 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements"
for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters on wall bracket.

   1. Maintain manufacturer's recommended clearances.
   2. Arrange units so controls and devices that require servicing are accessible.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.
   5. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

   1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.

C. Fill electric, domestic-water heaters with water.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."
3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation. Be sure units are full of water to eliminate dry-firing elements.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial and tankless, electric, domestic-water heaters.

END OF SECTION 22 33 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 22 Section "Water Distribution Piping Specialties" for backflow preventers and other specialties not specified in this Section.
   2. Division 23 Section "Pipe Insulation for Mechanical Systems" for piping.
   3. Division 22 Section "Drainage and Vent Piping" for pipe and fittings.
   4. Division 22 "Water Distribution Piping" for pipe and fittings.
   5. Division 26 "Electrical" for wiring for electrical appurtenances.

1.2 SUMMARY

A. This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.

1.3 DEFINITIONS

A. Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, showerheads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data for each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

C. Wiring diagrams from manufacturer for electrically operated units.
D. Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 01.

E. Each plumbing fixture shall comply with LEED standards that apply to the building.

1.5 QUALITY ASSURANCE


C. Backflow Prevention Requirements: Comply with the requirements of Washington State Department of Health regulation for "Backflow Prevention Assemblies Approved for Installation in Washington State".

D. Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.

B. Store plumbing fixtures on elevated platforms in dry location.

1.7 PROJECT CONDITIONS

A. Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.
PART 2 - PRODUCTS

2.1 PLUMBING FIXTURE STANDARDS

A. Comply with applicable standards below and other requirements specified.
   1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
   2. Vitreous-China Fixtures: ASME A112.19.2M.

2.2 LAVATORY/SINK FAUCET STANDARDS

A. Comply with ASME A112.18.1M and other requirements specified for lavatory, sink, and similar-type-fixture faucet fittings. Include hot- and cold-water indicators; and polished, chrome-plated finish; except where otherwise indicated. Coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
   3. Hose-Connection Vacuum Breakers: ASSE 1011.

2.3 MISCELLANEOUS FITTING STANDARDS

A. Comply with ASME A112.18.1M and other requirements specified for fittings, other than faucets. Include polished, chrome-plated finish, except where otherwise indicated. Coordinate fittings with other components and connectors.
   3. Brass and Copper, Supplies and Tubular Brass: ASME A112.18.1M.

2.4 MISCELLANEOUS COMPONENT STANDARDS

A. Comply with applicable standards below and other requirements specified for components for plumbing fixtures, equipment, and appliances.
5. Supports: ASME A112.6.1M.

2.5 FITTINGS

A. Fittings for Equipment Specified in Other Sections: Fittings include the following:
   1. Supply Inlets: Brass pipe or copper tube, size required for final connection.
   2. Supply Stops: Chrome-plated brass, angle or straight; compression, loose-key type; same size as supply inlet and with outlet matching supply riser.
   4. Traps: Cast Brass, slip-joint inlet, cleanout, wall flange, escutcheons, and size to match equipment. Use chrome-plated tube for exposed applications.
   5. Continuous Waste: Tubular brass with slip-joint inlet, and size to match equipment.
   6. Indirect Waste: Tubular brass size to match equipment.

2.6 FIXTURE LISTING

A. Refer to Plumbing Fixture Schedule on plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports match those indicated, before installing and connecting fixtures. Use manufacturer's roughing-in data when roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Include supports for plumbing fixtures according to the following:
   1. For wall hung water closets, urinals, lavatories, sinks, drinking fountains, and electric water coolers where indicated.
2. Reinforcement: For floor-mounted lavatories and sinks that require securing to wall and recessed, box-mounted, electric water coolers.

3. Fabricate reinforcement from 2-by-4-inch or 1/4-by-6-inch steel plates attached to studs, in wall construction, to secure fixtures to wall. Include length that will extend beyond ends of fixture mounting bracket and attach to at least 2 studs.

B. Include fitting insulation kits for accessible fixtures according to the following:
   1. Lavatories: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
   2. Sinks: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
   3. Fixtures with Offset Drain: Cover hot- and cold-water supplies, offset drain, trap, and waste to wall.
   4. Other Fixtures: Cover exposed fittings below fixture.

3.3 PLUMBING FIXTURE INSTALLATION

A. Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.

B. Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.

C. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

D. Install toilet seats on water closets.

E. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

F. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.

G. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.

H. Fasten recessed, wall-mounted fittings to reinforcement built into walls.

I. Fasten wall-mounted fittings to reinforcement built into walls.

J. Fasten counter-mounting plumbing fixtures to casework.

K. Secure supplies to supports or substrate within pipe space behind fixture.

L. Install individual stop valve in each water supply to fixture. Use gate or globe valve where specific stop valve is not specified.
1. Exception: Omit stop valves on supplies to emergency equipment, except when permitted by authorities having jurisdiction. When permitted, install valve chained and locked in OPEN position.

M. Install water-supply stop valves in accessible locations.

N. Install supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

P. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.

Q. Install hose bibs with integral or field-installed vacuum breaker.

R. Install wall hydrants with integral or field-installed vacuum breaker.

S. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

T. Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1-part, mildew-resistant, silicone sealant according to sealing requirements specified in Division 07 Section "Joint Sealants." Match sealant color to fixture color.

U. Coordinate exact location and mounting height of all fixtures with the architectural drawings.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 22 Sections.

B. Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedule on drawings for fitting sizes and connection requirements for each plumbing fixture.

C. Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.
D. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified in Division 26 Sections.

3.5 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.6 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:
   1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
   2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.
B. Do not allow use of fixtures for temporary facilities, except when approved in writing by Owner.

3.8 PLUMBING FIXTURE SCHEDULE

A. Refer to Plumbing Fixture Schedule on drawings.

B. Provide all options and accessories as indicated.

END OF SECTION 22 40 00
SECTION 22 64 00 - NATURAL GAS PIPING

PART 1 GENERAL

1.1 REQUIREMENTS

A. Provisions of Section 22 05 00 "Common work results for plumbing" apply to this Section.

1.2 DESCRIPTION

A. Included in this Section is natural gas pipe.

1.3 REGULATORY AGENCIES

A. All work shall be in conformance with applicable codes and with applicable standards.

1.4 REFERENCE STANDARDS

A. The publications of the organizations listed below form a part of this specification to the extent referenced.
1. American National Standards Institute, Inc. (ANSI)
3. American Welding Society (AWS) Publication
5. Manufacturers Standardization Society (MSS)
6. American Society of Mechanical Engineers (ASME)
7. Cast Iron Soil Pipe Institute (CISPI)

1.5 SUBMITTALS

A. Product Data:
1. Piping

PART 2 PRODUCTS

2.1 STEEL PIPE

A. Pressure Ratings: Provide pipe, fittings, accessories and all other components with minimum pressure rating of 150 psig.

B. Pipe: Black or galvanized steel, ASTM A 53, Grade A or B, electric resistance welded or seamless, standard weight unless otherwise noted.

C. Fittings
1. 2 Inches and Smaller
b. Welded: 3000 psig forged steel, socket weld.

2. 2-1/2 Inches and Larger
   a. Standard weight, seamless steel, butt welding, ANSI B16.09, Grade WPB.

3. Fittings for galvanized pipe shall be galvanized.

4. Fittings for steel drainage piping, ANSI B16.3.

D. Unions: 150 psig black or galvanized malleable iron, screwed, ASTM A 197, brass seat.

E. Flanges
   1. 2 Inches and Smaller: 125 psig cast iron screwed, ANSI B16.1 and ASTM A 126, Class B; 150 psig forged steel weld neck or slip on, ASME B16.5 and ASTM A 181, Grade I; 150 psig forged steel socket weld, ANSI B16.5 and ASTM A 181, Grade I.
   2. 2-1/2 Inches and Larger: 150 psig forged steel weld neck or slip on, ASME B16.5 and ASTM A 181, Grade I. NOTE: Flanges facing flat faced cast iron flanges will have flat face finish. Grooved joint flap adapters may be used in lieu of flanges on all pipe sizes.


G. Gaskets: ANSI B16.21 nonmetallic, 1/16 inch thick; Garlock Style 3000, Crane or US Rubber.

H. Joint Compound: Teflon tape.

I. Manufacturers: US Steel, LTV, Bethlehem, Laclede, Lone Star, Sawhill, Wheatland or Sharon.

PART 3 EXECUTION

3.1 GENERAL

A. Headroom
   1. Maintain the maximum possible headroom. Employ careful planning and proper fittings to give the best results coordinated with all other trades. If excessive space is taken, remove and replace the work in a proper manner.
   2. In ways of egress, pedestrian walkways, etc., maintain a minimum headroom of 6'8" from the floor to the bottom of an obstruction.

B. Diagram: Diagrams showing pipe connections are schematic only. Do not use for calculating piping lengths or numbers and types of fittings.

C. Connections to Equipment, Control Valves, Globe Valves, Balancing Valves, and Pressure Reducing Valves: Provide unions or flanges to allow local disassembly.
3.2 INSTALLATION OF PIPING AND VALVES

A. General
1. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
2. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the jobsite.
3. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load carrying members.
4. Use long radius elbows wherever possible.
5. Install all piping in accordance with ASME B31.9 "Building Services Piping" and as specified herein.

B. Location of Pipe: Piping layout as shown is diagrammatic indicating general arrangement. Determine measurements at jobsite, accurately cutting pipe to suit. Piping shall be installed so as to allow for expansion and contraction. Locate piping to avoid interference with building structural members, equipment, and building openings; provide access for operation, service, disconnection, removal and replacement of valves, fixtures, and equipment. Within buildings, conceal all piping in walls and above ceiling except where indicated to remain exposed. Provide separate trenches for water and sewer pipes.

C. Cleaning: Clean interior of piping before making joints and placing in position by blowing clean with steam or compressed air. Maintain cleanliness of piping throughout installation; provide caps or plugs on open ends of cleaned piping.

D. Unions and Fittings: Provide unions or flanges at valves, fixtures and equipment if a means of disconnection is not otherwise provided. Provide reducing fittings for all changes in pipe size; bushings are not acceptable. Use fittings for all changes in direction of piping.

E. Routing: Run parallel to column lines and perpendicular to the floor unless shown otherwise on drawings.

F. Leaks: Correct immediately, using new materials; leak-sealing compounds not permitted.

G. Valve Installation:
1. Install all gate valves and globe valves with stems horizontal or above horizontal.
2. Install chain wheel operators for all valves installed more than seven feet above the floor.
3. All valves shall be accessible.

H. Concealed Piping: Install all piping as concealed work in all finished areas, unless indicated otherwise. Do not cover up or enclose work until properly and completely inspected and reviewed. Should work be covered up or enclosed prior to inspections and reviews, uncover work as required an, after completely in-
spected and reviewed, make repairs and replacements with materials as necess-
ary and at no additional cost to Owner.

I. Dielectric Unions: Provide dielectric unions or flanges at each joint between dis-
similar metals, except that bronze valves and fittings may be used without dielec-
tric couplings for ferrous-to-ferrous or non-ferrous-to-non-ferrous connections.

J. Pipe Supports and Seismic Bracing: Provide in accordance with Section 220529, "Hangars and supports for plumbing piping and equipment".

3.3 WELDING OF PIPING

A. All welding shall be in accordance with ASME B31.9.

B. Unless stated otherwise, weld black steel piping 2-1/2 inch size and larger.

C. Skilled Welders: Employ only welders who hold one of the following certificates dated within the preceding 12 months:
   2. Certificate from a recognized testing laboratory indicating acceptable welding test results in accordance with the American Petroleum Institute "Standard for Field Welding of Pipe Lines" or ASME Boiler and Unfired Pressure Vessel Code, Section IX, "Welding Qualifications". If in the opinion of the A/E the work of any welder creates a reasonable doubt as to their skill, additional tests may be ordered by the A/E at the Contrac-
tor's expense.

D. Beveling: Do field bevels and shop bevels by mechanical means or by flame cut-
ting. Where beveling is done by flame cutting, thoroughly clean surfaces of scale and oxidation just prior to welding. Conform all beveling to recognized stand-
ards.

E. Alignment: Maintain true alignment for joints on all pipes 2-1/2 inches and larger; provide complete weld penetration; prevent weld spatter from reaching the interi-
or of the pipe; the use of split backing rings is optional.

F. Erection: Do not split, bend, flatten or otherwise deform piping before, during or after installation. During erection, take care to remove all dirt, scale and other foreign matter from inside the piping by use of a pipe swab or pipe "pig" before tying in sections, valves, equipment or fittings. Where the pipe temperature falls to 32 F or lower, heat the pipe to approximately 100 F for a distance of 1 foot each side of the weld before welding, and finish the weld before the pipe cools to 32 F.

G. Defects: Replace and reinspect defective welds at no additional cost to the Owner. Repairing defective welds by adding weld material over the defect or by peening will not be permitted.
H. Electrodes: Store electrodes in a dry heated area, and keep free of moisture and dampness during fabrication operations. Discard electrodes that have lost part of their coating.

END OF SECTION 23 64 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following to complement other Division 23 Sections:

1. Submittals.
2. Coordination Drawings.
3. Record Documents.
5. Concrete base construction requirements.
7. Mechanical sleeve seals.
8. Nonshrink grout for equipment installations.
10. Installation requirements common to equipment specification sections.
12. Mechanical 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 mechanical 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 Architect 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 mechanical installation, connecting to all equipment shown on the plans, or called for in the specifications. Mechanical contractor to provide any additional extra dampers and valves not shown on plans to obtain design criteria as required by the balancing contractor.

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 Architect shall determine which takes precedence and the Contractor shall perform the selected requirement without additional cost.

E. Mechanical Drawings:

1. Mechanical drawings do not attempt to show all aspects of building construction, which will affect the installation of mechanical systems. The mechanical drawings are diagrammatic and do not intend to show all offsets and fittings that may be required for a complete installation. Locations of equipment, pipes, valves, traps, ductwork, etc. shown on the drawings, shall be followed as closely as conditions will permit. Review all project drawings, including, but not limited to, architectural, structural and electrical drawings; and coordinate with all trades involved so there is no conflict with work of other trades and so Owner secures best arrangement of work consistent with use of space.
2. 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.
3. Changes in design, configuration, or location of equipment, piping, or ductwork, advisable in the opinion of Contractor, shall be submitted to Architect 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.
4. Check location of all work of all trades and avoid interferences. Special attention is called to the following items; conflicts shall be reported to Architect 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. The word "provide," as used in Division 23, means "furnish and install."

G. The word "approved," as used in these specifications, means acceptance by the Architect.

H. 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.

I. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted," mean directed by the Architect, requested by the Architect, and similar phrases.

J. Mechanical Systems - Including but not limited to:

2. Temperature Controls System.

K. Abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>AMCA</td>
<td>Air Moving and Conditioning Assoc.</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Inst.</td>
</tr>
<tr>
<td>ARI</td>
<td>Air Conditioning and Refrigeration Inst.</td>
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</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:

1. Uniform Plumbing Code, by International Association of Plumbing and Mechanical Officials.
4. Requirements of OSHA, EPA and WISHA.
5. ASME codes for boiler and pressure vessels.
7. All local and state amendments.
8. Requirements of all agencies have jurisdictional authority over installation of mechanical 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, steam, gas and drainage services, etc., 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 mechanical 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 Architect and use such equipment or material as approved by Architect.

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, ducts, caps and valves not shown on drawings, to maintain fully operational systems during the project at no additional cost to the owner.

1.7 WORKMANSHIP

A. This Contractor shall provide completed systems with a neat and finished appearance. If, in the judgment of the Architect, 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 Architect, 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 Division 23 Submittals: Provide the following submittals as indicated in each Division 23 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 Division 23 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, piping and ductwork, each section of shop fabricated duct or pipe and location of field joints, supports and building attachments, and seismic restraint locations.


4. Operation and Maintenance Data: Submit proposed Division 23 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. Number of Copies: Provide one additional copy of mechanical shop drawings and product data submitted over the number required in 01 Submittals, to allow for one copy of each submittal to be retained by the Mechanical Engineer. Additional copies may be required by individual sections of these Specifications.

D. Format: Provide submittals arranged with numerical index and tabs in 3-ring notebook 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 plumbing systems (Division 22), HVAC system (Division 23), and HVAC control system. 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 submittals shall indicate specifically the item for which approval is required in red ink, and submissions showing general information only are not acceptable.

E. 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. Split System
2. Heat Recovery Ventilator
3. Electric Unit Heater
4. Electric Duct Heater
5. Air Terminal Unit (Diffusers & Registers)

C. Shop Drawings: None required.

D. Reports and Certificates: None required.

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. Planned layout, including fan, coil, filters, and damper location.
3. Clearances for installing and maintaining insulation.
4. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
5. Equipment and accessory service connections and support details.
6. Other systems installed in same space as mechanical systems.
7. Exterior wall and foundation penetrations.
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 Engineer is the sole judge of the quality of the proposed substitution.

C. When the Engineer 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. Ductwork mains and branches, size and location, for both exterior and interior, locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.

2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.

3. Record drawings shall incorporate all accepted change orders and RFIs; reference number on drawings is not acceptable.

4. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

5. Approved substitutions, Contract Modifications, and actual equipment and materials installed.


7. 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. Division 23 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 23 materials:
1. Product Data of all Division 15 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 Division 23 systems and equipment as required by specifications.

5. Material Safety Data Sheets (MSDS) for all applicable materials used for Division 23 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 mechanical and electrical services, such as pipe and/or duct 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, ducts, 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, ducts, mechanical 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 mechanical 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. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. 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.

E. 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.

F. 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.

G. 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.

H. Use of the building HVAC systems, including those being provided under this contract, for temporary heating, ventilation or cooling during construction is prohibited. When system installation is complete and ready for start-up, approval to operate the system shall be obtained from the Owner or designated Owner’s representative.

1.17 COMMISSIONING SUPPORT

A. Provide the following support for project commissioning:

1. Attend commissioning scoping meetings. At a minimum, the Mechanical, TAB, and Controls Contractors shall participate. Equipment vendor representatives shall also attend upon request of the Commissioning Agent and Test Engineer. These meetings shall further define the testing requirements and participation of each contractor and sub-contractors for each commissioning activity.

2. Provide Commissioning Authority and Test Engineer additional requested data, prior to normal O&M Manual submittal, in a timely manner for the development of the startup plan and the functional performance testing procedures.

3. Provide startup forms and clearly document all completed startup activities. The DDC system startup forms shall include detailed checkout forms with descriptions for each controlled device. All forms shall be submitted for review by the Test Engineer and Commissioning Authority prior to use.

4. During the normal submittal processes, provide an additional copy of all equipment submittals, startup forms, field static testing reports (duct static pressure test reports, pipe static pressure test reports, chemical treatment reports, etc.), and TAB reports to the Commissioning Authority and Test Engineer for review.

5. Provide skilled technicians, including equipment vendor representatives, equipment, and materials to perform startup and execute functional performance tests.
DDC system sub-contractor shall provide skilled technicians, familiar with the project, for both startup (Owner-witnessed point-to-point testing) and functional performance testing. Commissioning functional performance testing participation from the controls contractor shall be required in addition to the point-to-point testing.

6. Submit startup documentation to General Contractor, Test Engineer, and Commissioning Authority to verify functional testing prerequisite requirements are fulfilled before functional testing for the associated equipment or system is scheduled to start. Refer to Section 23 08 00 – Commissioning of HVAC Systems, for commissioning procedure. Startup documentation (point-to-point testing) shall also be required from the controls contractor as a prerequisite to functional performance testing.

7. Correct deficiencies found during startup and functional performance testing in a timely manner to facilitate retesting activities within the commissioning schedule.

8. TAB sub-contractor shall report any deficiencies found in a timely manner. These deficiencies shall be corrected in a timely manner to facilitate functional performance testing within the commissioning schedule.

9. TAB sub-contractor shall coordinate all setpoint value requirements for input into the controls system, including minimum outside air damper positions, return/supply fan VFD speed mapping, pumping loop differential pressure setpoints, duct system static pressure setpoints, air terminal unit flow sensor calibration factors, etc.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Split Systems:
   a. Mitsubishi
   b. Daikin
   c. Approved equal

2. Heat Recovery Ventilator:
   a. Renewaire
   b. Lossinay
   c. Daikin
   d. Daikin
   e. Approved Equal

3. Electric Unit Heater:
   a. King
   b. Modine
c. Approved Equal

4. Duct Heater:
   a. Renewaire
   b. Indeeco

5. Diffusers/Registers:
   a. Titus

6. Mechanical Sleeve Seals:
   a. Calpico, Inc.
   b. Metraflex Co.
   c. Thunderline/Link-Seal.
   d. Innerlynx

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for 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. Solder Filler Metals: ASTM B 32.

   1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
   2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
D. Brazing Filler Metals: AWS A5.8.
   1. BCuP Series: Copper-phosphorus alloys.
   2. BAg1: Silver alloy.

E. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

F. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
   2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
   5. Finish: Enamel paint.

2.4 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.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking EPDM rubber links shaped to continuously fill annular space between pipe and sleeve. Stainless steel connecting bolts and composite pressure plates.

2.6 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.
   4. Cast-Iron Floor Plate: One-piece casting.

2.7 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 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate mechanical 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 mechanical 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 mechanical 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 mechanical systems with exterior underground and overhead 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 ar-
rangements indicated by the Contract Documents, recognizing that portions of
the work are shown only in diagrammatic form. Where coordination require-
ments conflict with individual system requirements, refer conflict to the Architect.

9. Install systems, materials, and equipment level and plumb, parallel and perpen-
dicular to other building systems and components, where installed exposed in fin-
ished spaces.

10. Install mechanical equipment to facilitate servicing, maintenance, and repair or
replacement of equipment components. As much as practical, connect equip-
ment for ease of disconnecting, with minimum of interference with other installa-
tions. Extend grease fittings to an accessible location.

11. Install access panel or doors where units are 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. Replace all air filters with new filters upon Owner taking occupancy of the build-
ing or at a time mutually agreed upon between the Owner and Contractor.

14. Do not install ductwork in elevator machine rooms, electrical and/or communica-

B. Locate wall, floor and ceiling fire ratings from architectural drawings for appropriate
hourly rating of combination fire/smoke dampers or fire dampers shown on mechanical
drawings.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise.
Individual Division 23 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indi-
cate general location and arrangement of piping systems. Indicated locations and ar-
rangements were used to size pipe and calculate friction loss, expansion, pump sizing,
and other design considerations. Install piping as indicated, unless deviations to layout
are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equip-
ment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas
at right angles or parallel to building walls. Diagonal runs are prohibited unless specifi-
cally indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel
removal.

F. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

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 plus 1-inch clearance around insulation.
J. Select system components with pressure rating equal to or greater than system operating pressure.
K. 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.
L. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
M. Install flexible connectors according to manufacturer's written instructions where indicated and specified in other Division 23 sections.
N. Install couplings according to manufacturer's written instructions.
O. Install Portable Instrument Connections in all piping systems where DDC temperature and/or pressure sensors and thermometers and/or pressure gauges are located.
P. Do not route piping through elevator equipment rooms, unless specifically allowed by local authority.
Q. Do not route piping over electrical panels, transformers, switchgear or other electrical equipment.
R. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
   1. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
   2. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
   3. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
   4. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.
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. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

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.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."

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. 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.
   2. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   3. Align threads at point of assembly.
   4. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. 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.

3.4 PIPING CONNECTIONS

A. 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. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to 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 mechanical 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.

3.6 PAINTING AND FINISHING

A. Refer to Division 09 for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping, ductwork 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 and ductwork: 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.

3.7 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions for all floor-supported units. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Concrete and reinforcement as specified in Division 03.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.9 DEMOLITION

A. Perform all demolition or interface work required in the existing building for the removal of, or interface with, existing mechanical equipment, ductwork, tubing, or piping. Relocate or modify the existing piping, tubing and ductwork as required by any general construction alterations or by the installation of new ductwork, tubing, or piping in the existing building.

B. Existing Materials, Removal and Disposition:

1. Scope: For mechanical 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 Architect.

F. Notify Architect in discovery of any hazardous materials.

G. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.10 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 mechanical 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 Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove and legally dispose off-site of selected mechanical equipment, components, and materials, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical 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 mechanical installations. Perform cutting by skilled mechanics of trades involved.

F. Repair cut surfaces to match adjacent surfaces.
3.11 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical 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 bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

3.12 EARTHWORK

A. General: Perform earthwork required for installation of mechanical work below grade in accordance with Division 2.

B. Excavate trenches to uniform widths to provide a working clearance on each side of the pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated. Grade trench bottoms to provide uniform bearing and support for each section of pipe. Form holes and depressions for joints after trench bottom has been graded. Provide temporary pumping equipment to keep excavation free from water. Install pipe bedding in rock excavation consisting of not less than 6 inch of sand or equivalent material.

C. Provide bracing and shoring as necessary.

D. Backfill trenches only after completion of pressure tests and inspection. Carefully compact material under pipe and bring backfill evenly up on both sides and along the full length of piping or conduit. Cover to 12-inch thickness over top of pipe. Fill and tamp remainder of backfill material in 6-inch layers. Provide backfill materials generally consisting of clean earth or sand relatively free of clods or stones. For sewer and water piping, use pea gravel. For gas piping, use sand. Backfill under, around, and to 6 inch above top of piping. In addition, wherever paving or future paving is indicated over backfill, provide remainder of backfill with satisfactory soil, ASTM D 2487 soil classification groups GW, GP, GM, SW, SP and SM or a combination of these.

E. Compact soil to 6-inch layer (maximum) loose thickness of backfill. Where roadway or parking area surfaces will be placed over backfill, provide moisture conditions, which
will produce compacted density of 95 percent of maximum density. Elsewhere, 90 percent. Test in accordance with Divisions 1 and 2.

F. Take special care in compacting under services where they enter building to prevent settling. Contractor fully responsible for damage to piping and property as a result of settling around service piping.

G. Dispose surplus materials off-site in a suitable location.

H. Place and maintain barricades, construction signs, torches, lanterns, and guards as required during periods of open excavation to protect persons from injury and to avoid property damage.

I. Leave premises thoroughly clean at completion of earthwork.

J. Wherever piping is to be installed in areas, which have been excavated below pipe invert, for any purpose, install piping to prevent subsequent settlement. Do not install piping until backfill is to full compaction, completed to minimum 18 inch above installed pipe. Install piping in re-excavated trenches and backfill as previously specified.

END OF SECTION 23 05 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.2 SUMMARY
A. This Section includes basic requirements for factory-installed motors provided with equipment specified in other sections of Division 23.

1.3 SUBMITTALS
A. Product Data: Include each piece of motorized equipment: Complete nameplate data and ratings; insulation class, NEMA design, frame size, enclosure type, bearing type, type of lubrication, service factor; mounting arrangements; size and coatings. Motor wiring and connection diagrams for all external connections and drawing showing location of winding termination lugs, conduit entry, and grounding lug.
B. Manufacturer’s Shop Test Reports: Submit only if specifically requested.

1.4 QUALITY ASSURANCE
B. All materials and equipment specified herein shall be within the scope of Nationally Recognized Testing Laboratory (NRTL) examination services, be approved by the NRTL for the purpose for which they are used, and shall bear the appropriate listing label. Any NRTL listing/label shall be as accepted by the local authority having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Motors:
   a. General Electric.
   b. Siemens.
   c. Century.
   d. U.S. Motors.
   e. Reliance.
   f. Baldor.

2.2 GENERAL REQUIREMENTS

A. Design and Construction: Motors and enclosures to conform to requirements of latest publication of NEMA Standard MG 1.

B. Motors Smaller than 1/2 HP: Single phase.

C. Efficiency: Premium efficiency as defined by NEMA MG 1, unless otherwise indicated.

D. Nameplates: Provide motors with stainless steel nameplates, secured with stainless steel fasteners, containing information required in NEMA MG 1; and motor connection diagram if more than three motor leads enter the motor terminal box.

E. Frequency Rating: 60 Hz.

F. Voltage Rating: Determined by voltage of circuit to which motor is connected or as indicated. Motor shall be capable of normal operation with voltage variations of plus or minus 10% of nameplate rating.

G. Service Factor: Provide motors with 1.15 service factor, unless otherwise indicated.

H. Duty and Torque Characteristics: Rated for continuous duty; sufficient to start, accelerate, and operate connected loads at designated speeds, in environments ranging from –4 to 104 Deg F, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

I. Enclosure Type:
   1. Indoor Service: Totally Enclosed Fan Cooled (TEFC) or Open Drip-Proof (ODP); provide ODP unless otherwise indicated. Provide drain plugs at the lowest part of the motor housing.
   2. Outdoor Service: Totally Enclosed Fan Cooled (TEFC) or Totally Enclosed Air Over (TEAO); provide TEFC unless otherwise indicated. Furnish with drain and breather plugs.

J. Vertical Motors: Motors used in vertical configuration shall be specifically designed to operate in vertical installation. Universal position motors are not acceptable. Thrust bearing rating shall be compatible with the loads imposed by the driven equipment.
2.3 SINGLE-PHASE MOTORS

A. Description: Single-phase, single speed, 115/230V or 115-208/230V as indicated, designed for continuous duty. In addition to requirements listed under General Requirements, provide motors with following:

1. Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.
   a. Permanent-split capacitor.
   b. Split-phase start, capacitor run.
   c. Capacitor start, capacitor run.
   d. Shaded-pole: Do not use unless motors are smaller than 1/20 hp.

2. Thermal Protection: Internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device automatically resets when motor temperature returns to normal range.

3. Insulation: NEMA Class B insulation, unless otherwise indicated.

4. Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, pre-lubricated sleeve bearings for other single-phase motors.

5. Enclosures: Heavy fabricated steel or cast iron.

6. Finish: Coat parts with zinc-rich primer prior to final coats of epoxy enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The motor installation shall be in conformance with the motor manufacturer's recommendations. Motors shall be factory installed on, aligned and connected to driven equipment, common bases, stands, etc., with the driven equipment.

B. Electrical Connections: Install electrical connectors and terminals according to manufacturer's recommendations. Verify motor is properly grounded.

END OF SECTION 23 05 13
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment" for vibration isolation and seismic restraint devices for piping and equipment.

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems, and/or heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Engineering Responsibility: Design and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

2. Comply with MSS SP-69.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Pipe Hangers:
   a. B-Line Systems, Inc.
   b. Tolco.
   c. Anvil Corp.
   d. Erico International Corp.
   e. National Pipe Hanger Corp.

2. Channel Support Systems:
   a. B-Line Systems, Inc.
   b. Anvil Corp.
   c. Tolco.
   d. Unistrut Corp.

3. Thermal-Hanger Shield Inserts:
   a. Carpenter & Patterson, Inc.
   b. PHS Industries, Inc.
   c. PT&P, Pipe Shields, Inc.
   d. Rilco Manufacturing Co., Inc.
   e. Value Engineered Products, Inc.

4. Powder-Actuated Fastener Systems:
   a. Gunnebo Fastening Corp.
   b. Hilti, Inc.
   c. ITW Ramset/Red Head.
   d. Masterset Fastening Systems, Inc.
2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
   1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
   2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
   2. Coatings: G90 galvanized coating. Threaded hardware, zinc plated.
   3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.
   1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
   2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
   3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
   4. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
   5. All insulated pipe supports shall be load rated. Load ratings shall be established by pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes: ASME B31.1, MSS SP-58, MSS SP-69, and MSS SP-89.
   6. Load tests shall be made on both supporting materials and configurations. All tests shall be performed by an independent testing laboratory. Results of pertinent tests shall be available, on request, to the purchaser.

2.3 MISCELLANEOUS MATERIALS

A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

C. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, non-shrink, and nonmetallic, dry, hydraulic-cement grout.
   1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
   2. Properties: Non-staining, non-corrosive, and non-gaseous.
   3. Design Mix: 5000-psi, 28-day compressive strength.
PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
   1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
   2. 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.
   3. 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.
   4. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
   5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
   6. 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.
   7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
   8. 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.
   9. 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.
  10. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
  11. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

C. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

D. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification 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 degrees piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg f piping installations.

E. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification 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. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
3. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
4. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
5. 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.

F. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.
3. Thermal-Hangar Shield Inserts shall be supplied and installed by the mechanical contractor on all insulated pipe and tubing.

G. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
2. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
3. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
   1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A36/A36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

E. If concrete inserts cannot be used, install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. 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.

H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

J. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span 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.

3. 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.

4. Insert Material: Length at least as long as protective shield.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor where indicated.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section includes vibration isolators, vibration isolation bases, vibration isolation roof curbs.
   2. This Section includes seismic restraint requirements for suspended pipes, ducts, and mechanical equipment with and without vibration isolation.

1.2 DEFINITIONS

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).
D. SEI/ASCE 7: American Society of Civil Engineers; Minimum Design Loads for Buildings and Other Structures.

1.3 ACTION SUBMITTALS

A. General: See Section 210500 for general requirements of Product Data, Shop Drawings, Reports and Certificates, and Operation and Maintenance data submittals.
   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 seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by OSHPD.
      b. Annotate to indicate application of each product submitted and compliance with requirements.
   3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Product Data: Provide submittals of the following:
   1. Vibration isolators.
   2. Anchor Bolts, Washers, and Bushings
   4. Seismic Restraint Devices

Vibration Isolation Equipment Bases.
C. Shop Drawings: In addition to requirements set forth in Section 23 05 00, shop drawings for the listed systems shall also include detailing of riser supports, vibration isolation base details, seismic-restraint systems, and suspended elements. Provide submittals of the following piping systems within the entire building:

1. For Vibration Isolated Elements:
   a. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
   b. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
   c. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate layout, quantity, diameter, anchor depth of embedment and, if mounted on housekeeping pads, indicate anchor minimum edge distance requirements.
   d. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.

2. For Suspended Elements: Prior to installation, submit seismic restraint manufacturer’s layout of all required bracing locations on contractor shop drawings. Layout to be signed and sealed by a qualified professional engineer. Layout to include manufacturer’s bracing legend indicating:
   a. Type of braced element.
   b. Seismic restraint hardware call-out.
   c. Minimum required vertical support rod diameter.
   d. Maximum allowable brace spacing.
   e. Brace reaction at full design load.
   f. Minimum required seismic restraint anchorage.
   g. Installation detail drawing number.
   h. Anchorage installation detail drawing number.

D. Design Calculations: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind 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 Division 23 Sections for equipment mounted outdoors.
b. To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

c. Pre-approval and Evaluation Documentation: By OSHPD, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this Project in material, design, and extent. This professional engineer shall develop a Quality Assurance Plan.

B. Testing Agency Qualifications (Owner will engage): An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

C. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Any device that provides seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, showing maximum seismic-restraint ratings. If preapproved ratings are not available, 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.

1.6 FIELD QUALITY CONTROL

A. Provide a Quality Assurance Plan that complies with SEI/ASCE 7, Appendix 11A for the following mechanical systems or equipment.

1. Flammable, combustible, or highly toxic piping systems and their associated mechanical units in Seismic Design Categories C, D, E, or F.
2. Installation of HVAC ductwork that will contain hazardous materials in Seismic Design Categories C, D, E, or F.
3. Installation of vibration isolation systems where the maximum clearance (air gap) between the equipment support frame and restraint is less than or equal to 1/4-inch.
4. Installation of seismic restraint systems for Seismic Use Group II and III.

B. The Contractor shall submit a written Contractor's statement of responsibility to the regulatory authority having jurisdiction and the Owner prior to the commencement of work. The Contractor's statement of responsibility shall contain the following:
   1. Acknowledgement of awareness of the special requirements contained in the Quality Assurance Plan.
   2. Acknowledgement that control will be exercised to obtain conformance with the design documents approved by the authority having jurisdiction.
   3. Procedure for exercising control within the Contractor's organization, the method and frequency of reporting, and the distribution of the reports.
   4. Identification and qualifications of the person exercising such control and their position in the organization.

C. The Owner shall employ a special inspector to observe the construction of all seismic systems in accordance with the Quality Assurance Plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design seismic and vibration isolation systems, including drawings, calculations, and material specifications prepared according to current IBC and SEI/ASCE 7 for obtaining approval from authorities having jurisdiction. Seismic and vibration systems shall be selected for the approved Project equipment, piping and ductwork components.

B. Wind-Restraint Loading:
   1. Basic Wind Speed: 110 MPH.
   2. Minimum 10 lb/sq. ft.multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

C. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: E.
   2. Assigned Seismic Use Group or Building Risk Category as Defined in the IBC: II.
      a. Component Importance Factor: 1.5 for all life safety systems and equipments required to function after an earthquake and all mechanical equipment that would impede egress from building. All
systems and equipment that contain hazardous content. All other systems, equipment, piping and ductwork shall be Ip=1.0.

3. Component Response Modification Factor (Rp) and Component Amplification Factor (Ap): From SEI/ASCE 7 (2005), Table 13.6-1, Seismic Coefficients for Mechanical and Electrical Components.

4. Seismic Design Category: D.

2.2 MANUFACTURERS

A. Vibration Isolation: Subject to compliance with requirements, provide products by the manufacturers specified.
   1. Amber/Booth Company, Inc.
   2. Kinetics Noise Control, Inc.
   4. Mason Industries, Inc.

B. Seismic Restraint for Suspended Elements: Subject to compliance with requirements, provide products by the manufacturers specified.
   1. International Seismic Application Technology (ISAT).
   2. Kinetics Noise Control, Inc.

2.3 VIBRATION ISOLATORS

A. Type V-1, Elastomeric Isolator Pads: Oil- and water-resistant neoprene or natural rubber, molded with a nonslip, ribbed or waffle-pattern steel load distribution plates of sufficient stiffness for uniform loading over pad area, factory cut to sizes that match requirements of supported equipment.
   1. Basis of Design: Mason Models W and WM.
   4. Thickness: 5/16 inch thick.
   5. Isolator shall be loaded to limit surface pressure to a maximum of 50 psi.

B. Type V-2, Elastomeric Isolator Pads: Oil- and water-resistant neoprene or natural rubbermolded with a nonslip, ribbed or waffle-pattern steel load distribution plates of sufficient stiffness for uniform loading over pad area factory cut to sizes that match requirements of supported equipment.
   1. Basis of Design: Mason Model Super W and Super WM.
   4. Thickness: 3/4-inch thick.
   5. Isolator shall be loaded to limit surface pressure to a maximum of 50 psi.

C. Type V-9, Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Basis of Design: Mason Model 30N.
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Elements: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

D. Type V-10, Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop and deflection scale.
1. Basis of Design: Mason Model PC30N.
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Elements: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Adjustable Vertical Stop: Steel washer encapsulated in a molded neoprene rebound washer on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

E. Type TR-1, Thrust Restraint: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.
1. Basis of Design: Mason Models WBI and WBD.
2. Frame: Steel, fabricated for connection to threaded rods.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. **Coil Spring:** Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

F. **Pipe Riser Resilient Support:** All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch thick, 60 durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psi and for equal resistance in all directions.

1. **Basis of Design:** Mason Model ADA.

G. **Resilient Pipe Guides:** Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch-thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

1. **Basis of Design:** Mason Model VSG.

2.4 **ANCHOR BOLTS, WASHERS, AND BUSHINGS**

A. **Resilient Isolation Washers and Bushings:** 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer rating of 50 with a flat washer face.

1. **Basis of Design:** Mason Model HG.

2. **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.

3. **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.

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 E 488. Minimum length of eight times diameter.

1. **Basis of Design:** Hilti Kwik Bolt TZ Mechanical Anchor for seismic restraints.

2. **Basis of Design:** Hilti Undercut HDA anchors for direct attachment to equipment 10 hp and greater.

2.5 **SEISMIC-RESTRAINT DEVICES**

A. **General Requirements for Restraint Components:** Rated strengths, features, and applications shall be as defined in OSHPD pre-approval.

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.
B. Type S-1, Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
   2. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and female-wedge or stud-wedge type.

C. Type S-2, Suspended Elements:
   1. Design Requirements: Seismic restraint hardware to be furnished in manufacturer’s pre-assembled “kits” labeled for installer cross reference with manufacturer’s layout performed on contractor shop drawings. Kits to be labeled as to “kit number,” “trade” and “floor.” Kits to include:
      a. All required seismic bracketry correctly sized for attachment to vertical support rods.
      b. Rod stiffeners as required based on rod diameter and length.
      c. Correct anchorage hardware for connection to concrete deck, structural steel, or wood structural members.
      d. Complete installation instructions.
   2. Rigid seismic restraint brace arm assemblies: Designed for strut nut attachment to minimum 12 gage steel channel with pregalvanized zinc finish per ASTM A525, solid, punched or short slot per engineering calculations.
      a. Basis of Design: Pre-engineered brackets with OSHPD pre-approval. Hinged seismic brackets.
      b. Assembly: Brackets to be provided from manufacturer with integral 1/2” hex bolts and strut nuts.
   3. Cable seismic restraint brace arm assemblies: Minimum 7 x 19 pre-stretched galvanized steel aircraft cable appropriately sized for the system load.
      a. Basis of Design: Pre-engineered brackets with OSHPD pre-approval.
      b. Design Requirements: Hinged seismic brackets.
      c. Assembly: Brackets factory pre-tied to made-to-length aircraft cable, with integral method for length adjustment by installer.
   4. Cast-In Place Deck Inserts: For vertical supports and seismic restraint anchorage.
      a. Basis of Design: Pre-engineered inserts with OSHPD pre-approval.
      b. Design Requirements: For form pour slabs, for metal decks with concrete, internally threaded to accept threaded rod diameters, with an OSHPD approval or other enforcement agency approval. Coordinate installation locations with manufacturer’s lay out of seismic restraint locations on contractor’s shop drawings.
2.6 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and tested equipment before shipping.
   1. Epoxy Powder coating or electro-galvanized isolation on springs and housings. Zinc plate all bolts, nuts and washers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by OSHPD.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be 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 Division 03.

B. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

C. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

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. Install seismic-restraint devices using methods approved by 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 o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

F. Ductwork Restraints:
2. Use Seismic Hazard Level A.

G. Install seismic-restraint devices using methods approved by 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. Attachments to Structure:
1. Install cables so they do not bend across edges of adjacent equipment or building structure.
2. Install seismic-restraint devices using anchor bolts that meet building code requirements for testing and approval.
3. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and oversize mounting hole.
4. 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.
5. If specific attachment to structure is not indicated, anchor bracing to structure at flanges of beams at upper chords of bar joists, or at concrete members. Obtain approval of the structural engineer prior to installation.

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. Set anchors to manufacturer’s recommended torque, using a torque wrench.

5. 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 230500 “Common Work Results for HVAC”.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 EXAMPLE HVAC VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

<table>
<thead>
<tr>
<th>EQUIPMENT DESCRIPTION</th>
<th>MARK</th>
<th>VIBRATION ISOLATOR TYPE</th>
<th>MINIMUM DEFLECTION (INCHES)</th>
<th>BASE/CURB TYPE</th>
<th>SEISMIC RESTRAINT DEVICE TYPE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDENSING UNITS</td>
<td></td>
<td></td>
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<td>EQUIPMENT DESCRIPTION</td>
<td>MARK</td>
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</tr>
<tr>
<td>CONDENSING UNITS</td>
<td>CU-X</td>
<td>V-2</td>
<td>0.11</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>AIR-COOLED CONDENSERS</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIR-COOLED CONDENSERS</td>
<td>HP-X</td>
<td>V-2</td>
<td>0.11</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>FANCOIL UNITS</td>
<td>FCU-X</td>
<td>V-9</td>
<td>1.0</td>
<td>N/A</td>
<td>S-2</td>
<td></td>
</tr>
<tr>
<td>FANS</td>
<td>EF-1</td>
<td>V-9</td>
<td>0.75</td>
<td>N/A</td>
<td>S-2</td>
<td></td>
</tr>
<tr>
<td>ENERGY RECOVERY UNITS</td>
<td>L-X</td>
<td>V-9</td>
<td>1.0</td>
<td>N/A</td>
<td>S-2</td>
<td></td>
</tr>
</tbody>
</table>

A. Vibration Isolator and Seismic Restraint Schedule Notes:

1. Seismic restraints are required for all systems and equipment. Seismic restraints for equipment without scheduled seismic snubbers shall be provided by the anchor bolts, vibration isolators, or devices as specified for suspended elements.

2. Provide vibration isolators and seismic restraints for all equipment as specified, including, but not limited to, the specific equipment marks listed above. Where a piece of equipment is included on the project but is not listed above, provide vibration isolators and seismic restraints as specified and as described for similar equipment.

3. Internal vibration isolators, snubbers, and bases for custom air handling units and custom exhaust fans shall be provided and installed at the fan manufacturer’s factory, except concrete for inertia bases will be field-installed as specified in this section.

4. Provide vibration isolators as indicated for suspended piping attached to any piece of vibrating equipment 5 horsepower or larger within mechanical rooms or within 50 feet of equipment, whichever provides the greater length. For piping supported from the floor, provide isolators similar to those used on the equipment. Applicable vibrating equipment includes items that are not internally isolated such as chillers, pumps, and air compressors.

5. The indicated equipment will be provided with internal vibration isolators.
END OF SECTION 23 05 48
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
   B. Related sections include the following:
      1. Division 09 for painting.

1.2 SUMMARY
   A. This Section includes the following mechanical identification materials and their installation:
      1. Equipment nameplates.
      2. Equipment markers.
      3. Pipe markers.
      4. Duct markers.
      5. Valve tags.
      6. Valve schedules.
      7. Warning tags.

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Valve numbering scheme.
   C. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

1.5 COORDINATION
   A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
   1. Data:
      a. Manufacturer, product name, model number, and serial number.
      b. Capacity, operating and power characteristics, and essential data.
      c. Labels of tested compliances.
   2. Location: Accessible and visible.
   3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Two-ply engraved black plastic with lettering cut through to white background. Include contact-type, permanent adhesive.
   1. Terminology: Match mark numbers on equipment schedules as closely as possible.
   2. Size: Minimum 1-1/2 by 4 inches.
   3. Thickness: 1/16-inch.

2.2 PIPING IDENTIFICATION DEVICES

A. Self-Adhesive Pipe Markers: Vinyl with pressure-sensitive, permanent type, self-adhesive back. Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   3. Full-band pipe markers extending 360 degrees around pipe at each location.
   4. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

2.3 DUCT IDENTIFICATION DEVICES

A. Self Adhesive Duct Markers: Vinyl with pressure-sensitive, permanent-type, self-adhesive back. Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use HVAC system terms and abbreviate only as necessary for each application length.
3. Arrows: Integral with HVAC system service lettering to accommodate both directions; or as separate unit on each duct marker to indicate direction of flow.

2.4 VALVE TAGS

A. Valve Tags: Two-ply engraved black plastic with lettering cut through to white background.
   1. Data: Service and identification number.
   2. 2-inch round, 1/16-inch thick, with 3/16-inch hole.
   3. Fastener: Brass chain or S-hook.

2.5 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Assign and 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-Schedule Frame: Mount valve schedule in frame with clear plastic cover, include mounting screws.

2.6 WARNING TAGS

A. Warning Tags: Preprinted plasticized card stock with matte finish.
   1. Size: 4 by 7 inches.
   2. Fasteners: Brass grommet and chain.
   3. Nomenclature: Large-size primary caption such as CAUTION: NONPOTABLE WATER, DO NOT DRINK.
   4. Color: Yellow background with 1/2-inch black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections.

3.2 EQUIPMENT IDENTIFICATION

A. Nameplate Installation: Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate
nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, and heaters.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Heat exchangers, electric coils, electric heaters, heat recovery units, and similar equipment.
4. Fans, blowers and air terminals.
5. Fan Coil Units.

B. Equipment Marker Installation: Install with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

2. Locate markers where accessible and visible. Include markers for all scheduled equipment.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows completely around pipe showing direction of flow. Apply to clean surface.

B. Locate pipe markers where piping is exposed in finished spaces, mechanical spaces; accessible maintenance spaces such as removable accessible ceilings, shafts, tunnels, and plenums; and exterior non-concealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers, minimum one in each space.
3.4 DUCT IDENTIFICATION

A. Install manufactured duct markers indicating service on each duct system. Install with flow arrows showing direction of flow.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

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; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and air terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

A. Attach warning tags to equipment and other items where required.

3.8 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

A. Clean faces of mechanical identification devices.

END OF SECTION 23 05 53
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including sub mains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
7. Reporting results of the activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to modify fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including sub mains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.
F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.


N. CTI: Cooling Tower Institute.


P. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

Q. TAB: Testing, Balancing, and Adjusting.

1.4 ACCEPTABLE CONTRACTORS

A. Neudorfer Engineers, Inc.

B. Hardin and Sons, Inc.

C. National Indoor Air Care.

D. Airtest Co., Inc.

1.5 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
B. Contract Documents Examination Report: Within 45 days from the Contractor’s Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. Strategies and Procedures Plan: Within 60 days from the Contractor’s Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

D. Report Forms: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

E. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

F. Balancing Report:
   2. Submit completed Balancing Report as indicated, including the following:
      a. System Diagrams/Floor Plans.
      b. Air Apparatus Test Reports.
      c. Apparatus Coil Test Reports.
      d. Electric Coil/Duct Heater Test Reports.
      e. Fan Test Reports.
      f. Rectangular and Round Duct Traverse Reports.
      g. Air Outlet Test Reports.
      h. Terminal Unit Coil Check Reports.
      i. Compressor and/or Condenser Test Reports.
      j. Heat Exchanger/Converter Test Reports.
      k. Pump Test Reports.

1.6 SEQUENCING/SCHEDULING
A. Phase in properly with Construction Schedule.

1.7 QUALITY ASSURANCE
A. Regulatory Requirements:
   1. Comply with all applicable city, county, and state codes and ordinances. In case of conflict with drawings or specifications, the codes and ordinances govern.
   2. Basis:
B. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by NEBB, not affiliated with mechanical contractor. Certified agent shall be a full-time employee of the TAB contractor.

C. Experience: Minimum 5 years on projects of similar scope and complexity.

D. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:
   a. Submittal distribution requirements.
   c. Testing, adjusting, and balancing plan.
   d. Work schedule and Project site access requirements.
   e. Coordination and cooperation of trades and subcontractors.
   f. Coordination of documentation and communication flow.

E. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.


G. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." Section II, "Required Instrumentation for NEBB Certification."

H. Instrumentation Calibration: Calibrate instruments as required by NEBB certification or more frequently if required by the instrument manufacturer.
1.8 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.9 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.10 WARRANTY

A. General Warranty: The special performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified Agent has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with "Quality Assurance" provisions, specifications, and manufacturer's data. Where these may be in conflict, the more stringent requirements govern.
2.2 TAB INSTRUMENTATION

A. Furnish materials and equipment necessary to properly measure system capacities, electrical voltage and current, fan speeds, static pressures, air velocities, water pressure drops, refrigeration pressures, and other readings necessary to evaluate system performance and adjust quantities to those indicated. TAB Contractor retains possession of materials and equipment after project is completed.

B. Instrumentation shall be accurate, with calibration histories available for examination upon request.

C. Instrumentation shall be used in accordance with manufacturer instructions.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not begin work until any unsatisfactory conditions are corrected.

3.2 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine project record documents described in Division 01 Section "Project Record Documents."

D. Examine equipment performance data, including fan and pump curves. 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.

E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
F. Examine system and equipment test reports.

G. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

H. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine strainers for clean screens and proper perforations.

J. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine equipment for installation and for properly operating safety interlocks and controls.

M. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices operate by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
   4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
   5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   6. Sensors are located to sense only the intended conditions.
   7. Sequence of operation for control modes is according to the Contract Documents.
   8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
   9. Interlocked systems are operating.
   10. Changeover from heating to cooling mode occurs according to design values.
   11. Verify minimum outdoor supply air setting.

N. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.3 PREPARATION

A. Field verify locations of new and existing work prior to commencing work of this Section.
B. Protect surrounding areas and surfaces to preclude damage from work of this Section.

C. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

D. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Manual volume dampers, smoke, fire, and combination fire/smoke dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.
9. Building construction is sealed in areas where specified pressurization of an area is designated on contract documents.

3.4 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB’s "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Set automatic stops on metering balancing valves and butterfly valves with memory and ensure volume damper locking mechanisms are tightened down in the balanced position.

3.5 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check the airflow patterns from the outside-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.

3.6 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.7 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, 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: As Work progresses, prepare 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.
3.8 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

   1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include the following:

   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

   1. Title page.
   2. Name and address of testing, adjusting, and balancing Agent.
   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 testing, adjusting, and balancing Agent who certifies the report.
   10. Summary of contents, including the following:

      a. Design versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.

   11. Nomenclature sheets for each item of equipment.
   12. Notes to explain why certain final data in the body of reports vary from design values.
   13. Test conditions for fans and pump performance forms, including the following:

      a. Settings for outside-, 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.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.

2. Duct, outlet, and inlet sizes.

3. Pipe and valve sizes and locations.


F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

   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. Sheave dimensions, center-to-center and amount of adjustments in inches.
   j. Number of belts, make, and size.
   k. Number of filters, type, and size.

2. Motor Data: Include the following:

   a. 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. Sheave dimensions, center-to-center and amount of adjustments in inches.

3. Test Data: Include design and actual values for the following:

   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. Outside airflow in cfm.
G. Apparatus-Coil Test Reports: For apparatus coils, include the following:

1. Coil Data: Include the following:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch.
   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: Include design and actual values for the following:
   a. Airflow rate in cfm.
   b. Average face velocity in fpm.
   c. Air pressure drop in inches wg.
   d. Outside-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. Refrigerant expansion valve and refrigerant types.
   i. Refrigerant suction pressure in psig.
   j. Refrigerant suction temperature in deg F.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data: Include the following:
   a. System identification.
   b. Location.
   c. Coil identification.
   d. Capacity in Btuh.
   e. Number of stages.
   f. Connected volts, phase, and hertz.
   g. Rated amperage.
   h. Airflow rate in cfm.
   i. Face area in sq. ft.
   j. Minimum face velocity in fpm.
2. Test Data: Include design and actual values for the following:

   a. Heat output in Btuh.
   b. Airflow rate in cfm.
   c. Air velocity in fpm.
   d. Entering-air temperature in deg F.
   e. Leaving-air temperature in deg F.
   f. Voltage at each connection.
   g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

   1. Fan Data: Include the following:

      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. Sheave dimensions, center-to-center and amount of adjustments in inches.

   2. Motor Data: Include the following:

      a. 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. Sheave dimensions, center-to-center and amount of adjustments in inches.
      g. Number of belts, make, and size.

   3. Test Data: Include design and actual values for the following:

      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.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

   1. Report Data: Include the following:

      a. System and air-handling unit number.
      b. Location and zone.
      c. Traverse air temperature in deg F.
      d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Design airflow rate in cfm.
h. Design velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data: Include the following:
   a. Unit identification.
   b. Location.
   c. Unit make and model number.
   d. Manufacturer's compressor serial numbers.
   e. Compressor make.
   f. Compressor model and serial numbers.
   g. Refrigerant weight in lb.
   h. Low ambient temperature cutoff in deg F.

2. Test Data: Include design and actual values for the following:
   a. Inlet-duct static pressure in inches wg.
   b. Outlet-duct static pressure in inches wg.
   c. Entering-air, dry-bulb temperature in deg F.
   d. Leaving-air, dry-bulb temperature in deg F.
   e. Control settings.
   f. Unloader set points.
   g. Low-pressure-cutout set point in psig.
   h. High-pressure-cutout set point in psig.
   i. Suction pressure in psig.
   j. Suction temperature in deg F.
   k. Condenser refrigerant pressure in psig.
   l. Condenser refrigerant temperature in deg F.
   m. Oil pressure in psig.
   n. Oil temperature in deg F.
   o. Voltage at each connection.
   p. Amperage for each phase.
   q. The kW input.
   r. Crankcase heater kW.
   s. Number of fans.
   t. Condenser fan rpm.
   u. Condenser fan airflow rate in cfm.
   v. Condenser fan motor make, frame size, rpm, and horsepower.
   w. Condenser fan motor voltage at each connection.
   x. Condenser fan motor amperage for each phase.
L. Condenser Test Reports: For condensers, include the following:

1. Unit Data: Include the following:
   a. Unit identification.
   b. Make and type.
   c. Model and serial numbers.
   d. Nominal cooling capacity in tons.
   e. Refrigerant type and weight in lb.
   f. Number and type of fans.
   g. Fan motor make, frame size, rpm, and horsepower.
   h. Fan motor voltage at each connection.
   i. Sheave make, size in inches, and bore.
   j. Sheave dimensions, center-to-center and amount of adjustments in inches.
   k. Number of belts, make, and size.

2. Air Data: Include design and actual values for the following:
   a. Duct airflow rate in cfm.
   b. Inlet-duct static pressure in inches wg.
   c. Outlet-duct static pressure in inches wg.
   d. Average entering-air, wet-bulb temperature in deg F.
   e. Average leaving-air, wet-bulb temperature in deg F.
   f. Ambient wet-bulb temperature in deg F.

M. Instrument Calibration Reports: For instrument calibration, include the following:

1. Report Data: Include the following:
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.9 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 23 05 93
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Division 07 for firestopping materials and requirements for penetrations through fire and smoke barriers.
   2. Division 23 Section "Metal Ducts" for duct liner.
   3. Division 23 Section "Hangers and Supports for Mechanical Piping and Equipment."
   4. Division 23 Section "Air Duct Accessories."

1.2 SUMMARY

A. This Section includes semirigid and flexible duct and plenum, insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.3 SUBMITTALS

A. General: See Section 230500 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. Mineral Fiber Board Insulation.
   3. Aluminum Jackets.
   4. Fire Barrier Duct Wrap with UL classification documentation.

C. Shop Drawings: None required.

D. Reports and Certificates: None required.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory labeled
insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

B. Underwriters Laboratories Inc (UL)
   1. UL 723, surface burning characteristic per ASTM E 84
   2. UL 1479, Through-Penetration firestop test.


D. American Society for Testing and Materials (ASTM):
   2. ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mineral-Fiber Insulation:
      a. CertainTeed Manson.
      b. Knauf Fiber Glass GmbH.
      c. Owens-Corning Fiberglas Corp.
2. Fire Barrier Duct Wrap:
   a. 3M Fire Barrier.
   b. Pyroscat Duct Wrap.
   c. Unifrax FyreWrap.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

2.3 FIELD-APPLIED JACKETS

A. Aluminum Jacket: Sheets manufactured from aluminum alloy complying with ASTM B 209 and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness is scheduled at the end of this Section.
   1. Finish: Embossed finish.
   2. Thickness: 0.04-inch thick.

2.4 ACCESSORIES AND ATTACHMENTS

A. Bands: 3/4-inch wide, aluminum band, minimum 0.007-inch thick.

B. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
   1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates. Perm rating not greater than 0.5 and all joints sealed.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

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 APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Cut insulation according to manufacturer’s written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

M. Install vapor-retarder mastic on supply and outside air ducts and plenums.
   1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
   2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
   3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

N. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
   1. Seal penetrations with vapor-retarder mastic.
   2. Apply insulation for exterior applications tightly joined to interior insulation ends.
   3. Seal insulation to roof flashing with vapor-retarder mastic.

O. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

P. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

Q. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
   1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with anchor pins and speed washers.
   1. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, 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 16 inches o.c. each way, and 3 inches maximum from insulation joints.
Apply additional pins and clips to hold insulation tightly against surface at cross bracing.

c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not over compress insulation during installation.

2. Impale insulation over anchors and attach speed washers.

3. 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. 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 segment with 1/2-inch staples, 1-inch o.c., and cover with pressure-sensitive tape having same facing as insulation.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.

6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply 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 the insulation surface with 6-inch wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.

8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts and Plenums: Secure board insulation with anchor pins and speed washers.

1. Space anchor pins as follows:
   a. On duct sides with dimensions 18 inches and smaller, 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 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
   c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not over compress insulation during installation.

2. 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.

3. 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 segment with 1/2-inch staples, 1-inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
4. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

5. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch-wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.

6. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FIRE BARRIER DUCT WRAP APPLICATION

A. Install fire barrier duct wrap and components in accordance with manufacturer’s instructions.

B. Coordinate installation and spatial requirements with Division 15 Sections “Metal Ducts” and “Duct Accessories.”

C. Install hangers and supports insulation to maintain fire resistive rating.

D. Install firestopping system at rated penetrations (wall, floors, ceilings, roof).

E. Verify duct access openings are not obstructed.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
   1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.
   3. Seal outdoor jacket watertight.
   4. Round Ducts: Overlap seams 45 degrees from bottom.

3.7 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:
   1. Supply-, return-, and outside-air ductwork.
2. Outside-air ductwork and exhaust-air ductwork shall be insulated from isolation damper to the exterior of the building.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Metal ducts with duct liner, unless required to meet the Energy Code requirements.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
4. Flexible connectors.
5. Vibration-control devices.
6. Testing agency labels and stamps.
7. Nameplates and data plates.
8. Access panels and doors in air-distribution systems.
11. Exposed ducts within a space that serves that space only.

3.8 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Supply and return-air ducts, concealed unconditioned space.
   2. Thickness: 2-inch.

B. Service: Round, supply and return-air ducts, conditioned space.
   3. Minimum Installed Insulation R-Value: 3.3.

C. Service: Rectangular, supply and return-air ducts, conditioned space.
   2. Thickness: 1 inch.
   3. Minimum Installed Insulation R-Value: 3.3.

D. Service: Round and rectangular, exhaust air, outside-air ducts downstream of duct heater.
   1. No insulation required.

E. Service: Round and rectangular, outside-air ducts, non-tempered air downstream of roof intake hood.
   2. Thickness: Layers as required to maintain minimum envelope R-Value.
3.9 OUTDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Round, supply and return-air ducts.
   2. Thickness: 3-inches.

B. Service: Rectangular, supply and return-air ducts.
   2. Thickness: 2 inches.

END OF SECTION 23 07 19
PART 1 - GENERAL

1.1 DESCRIPTION

A. Purpose

1. The purpose of the commissioning process is to provide the Owner assurance that the systems have been installed in the prescribed manner and will operate within the performance guidelines. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems to beneficial use by the Owner.

2. The Contractor verifies installation, provides scheduling and coordination of commissioning activities, performs training, starts up equipment, conducts functional performance testing, corrects deficiencies, performs retests, and provides documentation of the process.

3. The Commissioning Authority or Owner’s Construction Representative, hired directly by the Owner, provides the Owner an unbiased, objective view of the system’s installation, documentation, operation, and performance.

4. Commissioning procedures and results will be reviewed and observed by the Commissioning Authority. The Contractor is expected to verify the functional readiness of systems to be tested prior to performing the tests in the presence of the Commissioning Authority. A high rate of test failure will indicate that the Contractor has not adequately verified the readiness of the systems.

B. General

1. Furnish labor and material to accomplish building commissioning as specified herein.

2. Requirements of Commissioning Section shall be accomplished by a qualified Test Engineer, as specified in Division 01. The requirement for and responsibilities of the Test Engineer are indicated in Division 01 and Commissioning Section.

3. The Commissioning Authority is an independent contractor and will work under a separate contract directly with the Owner. The responsibilities of the Commissioning Authority are indicated, for information only, in Division 01.

4. Unless noted otherwise, functional performance tests (FPTs) described under “Acceptance Criteria” in the various sections of this division, apply to all equipment and systems identified under “Systems / Equipment to be Tested.”

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Related sections include the following:

1. Division 23 08 13 Section “Commissioning of Mechanical Systems – Functional Performance Testing.”
2. Division 23 08 16 Section "Commissioning of Mechanical Systems Support."

1.3 COORDINATION

A. The General Contractor and the Test Engineer shall provide overall coordination and management of the commissioning program as specified herein. The commissioning process will require cooperation of the Contractor, subcontractors, vendors, Architect, Mechanical Engineer, Electrical Engineer, Test Engineer, Commissioning Authority, and Owner.

1.4 SUBMITTALS

A. General: The Test Engineer shall submit the following with input from the Contractors, Sub-Contractors, and Vendors:

B. Commissioning plan: Submit (6) copies of a draft commissioning plan to the Owner's Representative for review and approval by the Architect and Commissioning Authority within 90 calendar days of Notice to Proceed. Submit (6) copies of the commissioning plan to the Owner's Representative after all review comments have been incorporated from the Architect and the Commissioning Authority. Develop a commissioning plan to identify how commissioning activities will be integrated into general construction and trade activities. The plan is the key means for the Test Engineer to inform all parties as to how each system functions, independently and with respect to other systems. The plan shall be updated regularly and redistributed to the commissioning team for review and comment. The intent of this plan is to evoke questions, expose issues, and resolve them with input from the entire commissioning team early in construction. The commissioning plan shall identify how commissioning responsibilities are distributed.

1. Include an organizational chart showing lines of communication and authority of the Test Engineer relative to key General Contractor positions and to key subcontractors.
2. Identify who will be responsible for producing the various procedures, reports, Owner notifications, and forms required in this division.
3. Include a summary of all commissioning tests to be performed.
4. Include the commissioning schedule.
5. Describe the test/acceptance procedure.
6. Identify which subcontractors will participate in each of the tests.
7. Identify instrumentation required for each test.
8. Identify who will provide instrumentation for each test.

C. Commissioning schedule: Submit (6) copies of a draft commissioning schedule to the Owner's Representative for review and approval by the Architect and Commissioning Authority within 90 calendar days of Notice to Proceed.
1. Integrate functional performance testing and commissioning requirements into the Critical Path Method (CPM) master construction schedule. Commissioning scheduling is the responsibility of the Contractor. The schedule shall include dates for commissioning testing of each system and shall also include startup
2. Commissioning of systems shall proceed per the criteria established in the specific sections that follow, with activities to be performed on a timely basis. Commissioning of systems may proceed prior to final completion of systems. The Test Engineer must be available to respond promptly to avoid delay to the CPM schedule.

3. The commissioning schedule shall incorporate the completion of all commissioning testing, with the exception of retesting resulting from deficiencies and seasonal testing, before the Final Certificate of Occupancy date.

4. Problems observed shall be addressed immediately, in terms of notification to responsible parties and actions to correct deficiencies.

D. Start-up plan: For each piece of equipment or system for which formal start-up is specified elsewhere in this division, submit a start-up plan to the Owner’s Representative for review and approval by the Architect and Commissioning Authority. Submit (6) copies of the draft startup plan. Submit (6) copies of the startup plan after all review comments have been incorporated from the Architect and Commissioning Authority. Obtain approval of the plan prior to beginning startup activities. The plan shall include the following:

1. Start-up schedule
2. Names of firms/individuals required to participate
3. Detailed start-up procedures (may be manufacturer’s startup checklist and procedures)
4. Start-up data forms

E. Test equipment identification list: For each instrument, sorted according to intended use, submit (6) copies of a list containing the following information to the Owner’s Representative for review and approval by the Architect and Commissioning Authority. Submit (6) copies of the list to the Owner’s Representative after all comments have been incorporated from the Architect and the Commissioning Authority:

1. Manufacturer
2. Model number
3. Serial number
4. Calibration certification
5. Range
6. Accuracy
7. Resolution
8. Intended use

F. Testing, Adjusting, and Balancing (TAB) data forms: In addition to the requirements for TAB submittals in other sections of this specification, submit (6) copies of the testing, adjusting, and balancing (TAB) data forms to the Owner’s Representative for review and approval by the Architect and Commissioning Authority. Submit (6) copies of the TAB forms after all comments have been incorporated from the Architect and the Commissioning Authority. Forms shall be approved prior to the start of TAB activities.
G. Testing, Adjusting, and Balancing (TAB) report: In addition to the requirements for TAB report submittals in other sections of this specification, submit (1) additional copy for review and approval by the Commissioning Authority. A preliminary TAB report shall be submitted first for approval. A final TAB report shall be submitted to incorporate review comments or, if additional TAB work is identified by the preliminary review comments, after the additional TAB work is completed.

H. Functional performance test procedures: Refer to Section 23 08 13 for additional requirements for functional performance test procedures. Submit functional performance test procedures for functional performance tests to the Owner’s Representative for review and approval by the Architect and Commissioning Authority.

1. Each procedure shall have a unique alphanumeric designator.
2. The same procedure may be applied to multiple identical pieces of equipment or systems.
3. FPT procedures shall be detailed test instructions, written with sufficient step-by-step information to allow a test to be repeated under identical conditions with repeatable results.

I. Functional performance test procedures: Submit (6) copies of the draft functional performance test procedures/data forms to the Owner’s Representative for review and approval by the Architect and Commissioning Authority.

1. Identify each functional performance test data form by a unique designator, consisting of the applicable functional performance test procedure designator followed by a dash and digit suffix to distinguish multiple repetitions of the same procedure.
2. 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. Observed conditions at each step of the procedure
   e. Date of the test
   f. Names and company of technicians performing the procedure
   g. Name and signature of the Test Engineer
   h. Name and signature of the Commissioning Authority or Owner-designated witness. 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.

3. Functional performance test procedures and functional performance test data sheets for each system shall be based upon actual system’s configuration.
4. Test procedures shall fully describe system configuration and steps required for each test, appropriately documented so that another party can repeat the tests with virtually identical results.
5. Acceptance test procedures must confirm the performance of systems to the extent of the design intent and applicable code under which the project was
permitted. When a system is accepted, the Commissioning Authority must be assured that the system is complete, works as intended, is correctly documented, and that the Owner's staff is trained in the operation and maintenance of the system.

6. The majority of mechanical equipment requires integral safety devices to stop/prevent equipment operation unless minimum safety standards or conditions are met. This could include adequate oil pressure, proof-of-flow, non-freezing conditions, maximum head pressure, etc. Functional performance test procedures shall demonstrate the actual performance of safety shutoffs in a real or closely simulated condition of failure.

7. 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. Functional performance test procedures shall demonstrate these interlocks.

8. Inform appropriate subcontractor(s) and vendor(s) before commissioning is started as to what the test and expected results will be. Because some test results and interpretations may not become evident until the actual tests are performed, all participants should have a reasonable understanding of the requirements. The commissioning plan must address the requirements and be distributed to all participants involved with that particular system.

J. Functional performance test deficiency report forms: Submit sample functional performance test deficiency report forms to the Owner's Representative for review and approval by the Architect and Commissioning Authority. Include space to record the following:

1. Associated functional performance test data form number
2. Date of test
3. Name of person reporting the deficiency
4. Description of the observations associated with the failure of the test
5. Cause of the failure if apparent at the time of the test
6. Date and description of corrective action taken
7. Name and signature of person taking corrective action
8. Schedule for retest

K. Owner Training Plan: Prepare and submit (6) copies of a training plan to the Owner's Representative for review and approval by the Architect and Commissioning Authority.

1. Training plan shall include for each training session 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

2. Obtain assistance from appropriate subcontractors and vendors to provide training for the Owner's operations staff.
3. Training will be in a classroom setting with the appropriate schematics, handouts, and audio/visual training aids.
4. Catalog training videotapes and deliver to the Owner with the O&M manuals.
5. Host each training session:
   a. Provide program overview and curriculum guidance.
   b. Obtain signatures of attendees on a sign-in list.

6. Equipment vendors provide training on the specifics of each system and philosophy, troubleshooting, and repair techniques as specified in the relevant sections of this specification.

7. Installation subcontractors provide training on peculiarities specific to this project and job specific experience as specified in the relevant sections of this specification.

8. Review record documents to verify accuracy.

1.5 COORDINATION WITH COMMISSIONING AUTHORITY

A. The Commissioning Authority will witness start-up and test activities specified in this division. The Owner's Representative will designate witnesses and alternates for each activity.

B. Notify the Owner’s Representative in writing of the date, time, location, and anticipated duration of start-up and test activities as required in “Schedule” above.

C. Provide written timely notice to Owner's Representative of any changes in date, time, location, or anticipated duration of start-up and test activities. For the purpose of this paragraph, written notice shall be received by Owner's Representative a minimum of 72 hours in advance to be considered timely notice.

D. Contractor shall reimburse Owner for actual costs incurred by the Owner as the result of failure to provide timely notice, per preceding paragraph, of changes in date, time, location, or anticipated duration of start-up and test activities.

E. Obtain the signature of 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.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide industry standard test equipment required for performing the tests specified herein. 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.
B. For all temperature measurements including air, liquids, and surfaces of pipes and components using appropriate probes:

1. Range: Minimum +15 ° F to 230° F
   a. Type: Thermometer, Digital Electronic
   b. Minimum accuracy: +/- 0.5° F
   c. Calibration Interval: Per manufacturer instruction, not to exceed every 12 months

C. For Hydronic pressure and differential pressure measurement instruments:

1. Range: 0 to 30 psi, 0 to 60 psi and 0 to 200 psi
   a. Type: Calibrated Test Gauges, 6 inch, or electronic digital device (Shortridge, Alnor, or equal) meeting accuracy and calibration interval requirements
   b. Minimum accuracy: 2% of scale (Gauge), 1% of reading (electronic)
   c. Calibration interval: Per manufacturers instruction, not to exceed every 12 months
   d. Note: Use lowest range instrument or scale.

D. Air pressure measurement instruments:

1. Range: 0 to 1 inch w.c., 0 to 4 inch w.c., 0 to 10 inch w.c.
   a. Type: Use properly leveled and zeroed manometer, Magnehelic or electronic instrument meeting accuracy requirements.
   b. Minimum accuracy for electronic devices: 2% of reading (Magnehelic or manometer), 1% of reading (electronic)
   c. Calibration Interval for electronic devices: Per manufacturer's instructions, not to exceed every 12 months
   d. Note: Use lowest range instrument or scale.

2.2 REPORTS

A. Installation verification audit: Prior to start-up, submit to the Owner's Representative for review and approval by the Architect and Commissioning Authority a report of installation verification audit activities. Identify equipment and components verified, deficiencies noted, corrective action taken, and the dates and initials of the persons making the entries.

1. During construction, observe the work of the prime Contractor and subcontractors to assure that all installations are being made in accordance with the intent of the contract documents.
2. Before system start-up begins, conduct a final installation verification audit. The Contractor shall be responsible for completion of all work, including change
orders and punch list items, to the satisfaction of the Owner's Representative. The audit shall include, but not be limited to, a check of the following:

a. Piping specialties, including balance, control, and isolation valves
b. Ductwork specialty items, including turning devices; balance, fire, smoke and control dampers; and access doors
c. Control sensor types and locations
d. Identification of piping, valves, starters, gauges, thermometers, etc.
e. Documentation of prestart-up tests performed, including manufacturer’s factory tests
f. Accessibility to equipment in 1-3 above

B. Start-up deficiency report: Within five days following start-up of each system or equipment, submit to the Owner's Representative start-up deficiency report forms. Identify systems and/or equipment started up, deficiencies noted, corrective action taken, and the dates and initials of the persons making the entries.

C. Functional performance test deficiency reports: Submit weekly functional performance tests deficiency reports to the Owner's Representative.

1. Identify tests for which acceptable results were not obtained by test number and description, and equipment identification and location. Briefly describe observations about the performance which were associated with failure to achieve acceptable results. Identify the cause of failure if such is apparent.
2. When corrections have been completed, update the functional performance test deficiency report forms. Identify corrective action taken and the dates and initials of the persons making the entries.
3. Identify the schedule for retesting.

D. Final Commissioning Reports: Submit (6) copies of the draft final commissioning report to the Owner's Representative for review and approval by the Architect and the Commissioning Authority. The draft final commissioning report shall be submitted a minimum of two weeks prior to the Final Certificate of Occupancy date. The draft final commissioning report shall include completed commissioning functional performance test procedures for all identified systems to be commissioned. For those systems that require re-testing due to deficiencies found during initial functional testing and those tests that require seasonal conditions to complete (i.e. – heating and cooling coil capacity tests), the initial completed functional test procedure shall be included in the preliminary final commissioning report. After all re-testing and seasonal testing has been completed, submit (6) copies of the final commissioning report to the Owner's Representative including the documentation for all re-testing and seasonal testing. The final commissioning report shall include the following items:

1. An executive summary including a brief description of the project, the commissioning process, and the results of the commissioning process.
2. A list of all outstanding items that were not resolved through the commissioning process.
3. Recommendations for system improvements that were not implemented through the commissioning process.
4. Log, list, or matrix of all deficiencies encountered during the course of functional performance testing.
5. All meeting notes.
6. All installation verification audits.
7. All startup deficiency reports.
8. All completed functional test procedures and data forms.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCEDURE

A. Sequence of testing: Commissioning shall proceed from lower to higher levels of complexity. For each discrete subsystem or 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. System startup static tests (e.g. duct leakage tests, pipe static pressure tests)
2. Contractor equipment startup and vendor equipment startup including unitary controls checkout
3. Controls startup and initial checkout (Point-to-Point testing)
4. Testing, Adjusting, and Balancing (TAB)
5. System functional performance tests (FPT)
6. Intersystem 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. Compensate the Owner for direct costs incurred as the result of tests repeated to achieve acceptable results. Fill out a new functional performance test data form for each retest.

C. Correction of deficiencies

2. Corrections during functional performance tests 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 minutes. If corrections are made under this exception, the failure shall be noted on the functional performance test data form. A new functional performance test data form, marked “retest,” shall be initiated after the correction has been made. The entire functional performance test procedure shall be repeated.

D. Owner witness: Commissioning Authority shall provide no labor or materials in the commissioning process. The only function of the Commissioning Authority shall be to observe and comment on the progress and results of commissioning.
1. Provide access to permit the Commissioning Agent to directly observe the performance of the equipment being tested.
2. Provide ladders, scaffolding, and staging as required to permit the Commissioning Agent to directly observe the performance of the equipment being tested.
3. Notify the Owner's Representative of commissioning schedule changes at least 48 hours in advance if a Commissioning Agent will be involved.

3.2 FUNCTIONAL COMPLETION

A. The Commissioning Authority will review Contractor's records of completion of Commissioning requirements. Upon receiving evidence of satisfactory completion of Functional Completion requirements, the Commissioning Authority will submit to the Owner a recommendation to accept Functional Completion.

3.3 EXCLUSIONS

A. The Owner's Representative and Commissioning Authority are not responsible for construction means, methods, job safety, or any management function related to commissioning on the job site.

B. The Contractor shall provide all technician services requiring tools or the use of tools, to test, adjust or otherwise bring equipment into a full operational state.

END OF SECTION 23 08 00
PART 1 - GENERAL

1.1 DESCRIPTION

A. The purpose of functional performance testing (FPT) is to assure the Owner that all work has been completed as specified and that systems are functioning in the manner intended, within the limits of the design and the contract documents. It will serve as a tool to minimize post-occupancy systems operational difficulty or failure. It will assist operations staff familiarization and training with new systems. It will also be used to develop test protocols and record associated test data in an effort to advance the building systems from a state of substantial completion to full dynamic operation. Functional performance testing will commence as systems startup and startup documentation is completed and reviewed and TAB work is completed. Functional performance testing will be done on a system-by-system basis. The results of these tests will be documented and handed over to the Commissioning Agent and Owner for final system acceptance.

B. Substantial Completion requires that:

1. All functional performance testing be complete and approved.
2. O&M manuals are complete (not in process).
3. All training is complete.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Division 23 Section “Commissioning of Mechanical Systems – General Requirements.”

B. Division 23 Section “Commissioning of Mechanical Systems Support.”

1.3 SYSTEMS TO BE TESTED

A. FPT will be performed on all energy-consuming systems and equipment and those mechanical systems that affect the performance of the dynamic functioning of the building. Those systems shall include the following:

1. HVAC
   a. Heating Hot Water System
   b. Make-up Water Systems
   c. Pressure Relief Devices
   d. 
   e. Heat Recovery Ventilator
   f. Unit Heaters
   g. Condensing Units (Outdoor)
   h. Fan Coil Units (Indoor)
2. Plumbing
   a. Domestic Hot Water Heaters
   b. Domestic Hot Water Pump
   c. Domestic Hot Water Recirculation System
   d. No-Touch Automatic Lavatory Faucets
   e. Trap Primer Systems
   f. Drinking Fountains
   g. Reduced-Pressure Backflow Preventers (may be satisfied by City Inspection Reports)

3. Controls
   a. Unitary Controls Sequences of Operation and Alarming
   b. Unitary Control Loop Stability for Each PI or PID Loop
   c. Unitary Controls Safety Features

PART 2 - PRODUCTS

Not applicable to this section

PART 3 - EXECUTION

3.1 GENERAL
   A. The Contractor and subcontractors shall be responsible for performing all procedures presented in the specification and contract drawings, unless otherwise specified. The Test Engineer and Commissioning Agent will witness system start up and functional performance for all systems listed in this division.

3.2 FUNCTIONAL PERFORMANCE TESTING
   A. Functional performance testing begins after the systems have been completed by the contractors, the system description and training sessions have been completed, and the O&M manuals have been completed.
   B. The objective of functional performance testing is to advance the building systems from a state of installation and startup completion to full dynamic operation in accordance with the specified design requirements and design intent.
   C. The Test Engineer shall attain this objective by developing individual system-testing protocols which, when implemented by the Contractor, will allow the Test Engineer to observe, evaluate, identify deficiencies, recommend modifications, tune, and document the systems and systems’ equipment performance over a range of load and functional levels.
D. Functional performance testing shall be conducted with the systems in full automatic operation, except as noted in the test procedures. Unless otherwise noted in the testing procedures, motor starter HOA switches shall be in the AUTO position.

E. Safety shutdowns (static pressure, freeze protection, etc.) for air handling unit systems shall be tested with the motor starter HOA switches in both the AUTO and HAND positions.

F. Equipment and control sequences shall be tested for equipment under every operating mode (e.g. – warmup, occupied, unoccupied, night setback, unoccupied over-ride to occupied, off, fire alarm mode, etc.)

G. All equipment safety devices shall be tested (e.g. – chiller low suction pressure cutout, chiller high head pressure cutout, chiller no flow shutdown, boiler no flow shutdown, boiler low/high gas pressure cut-out, boiler no draft airflow cut-out, boiler not flame sensor cutout, pressure relief valves, etc.). Coordinate with equipment vendors for safe procedures to test safety devices.

H. Testing of air terminal units shall be by statistical method. The Contractor shall still be required to perform complete startup and submit startup completion forms for each air terminal unit. For functional testing, the Test Engineer and Commissioning Agent will choose, at random, a sampling of 20% of the air terminal units for functional performance testing. If 90% of the functions for this representative sampling pass, then all of the air terminal units will be accepted. If less than 90% of the functions pass, then all of the air terminal units will fail. Upon failure of the first test, the Contractor shall be required to perform startup on all the air terminal units again. After startup is completed again, another 20% random sampling of the air terminal units shall be functionally tested again. The process shall be repeated until a 20% random sampling is found to pass the 90% functional criteria.

I. Air Handling Unit coil capacity tests shall be performed, using dry bulb and wet bulb temperatures for cooling coils. This testing may require seasonal testing in order to obtain the design entering air conditions to the coils.

J. Domestic Water Heaters shall be tested for recovery time and for effectiveness of the recirculation system.

K. A two-week trending process shall occur after all individual functional test procedures have been completed and passed. This trend shall be used to demonstrate the functioning of mechanical systems under complete automatic control. The Contractor shall correct all deficiencies found during this trending process.

END OF SECTION 23 08 13
PART 1 - GENERAL

1.1 SCOPE OF THE WORK

A. The purpose of this section is to specify Division 21, 22, and 23 responsibilities and participation in the commissioning process.

B. Commissioning is the responsibility of the Contractor (including subcontractors and vendors). The Contractor is responsible for providing all scheduling, coordination and support required for start-up, testing, and commissioning (see Division 01). Commissioning Section is intended to provide an indication of the tests which must be performed by the Contractor prior to and including verification by the Owner’s Representative. The commissioning process requires Division 21, 22, and 23 participation to ensure all portions of the work have been completed in a satisfactory and fully operational manner.

C. Work of Division 21, 22, and 23 includes the following:
   1. Attend commissioning scoping meetings. At a minimum, the Mechanical, TAB, and Controls Contractors shall participate. Equipment vendor representatives shall also attend upon request of the Commissioning Agent and Test Engineer. These meetings shall further define the testing requirements and participation of each contractor and sub-contractors for each commissioning activity.
   2. Attend other meetings as required to facilitate the commissioning process. This shall include bi-monthly meetings during the startup period and weekly meetings starting at the beginning of the Owner-witnessed point to point and Functional Testing period. Other meetings may be required as problems arise, apart from the regularly-scheduled commissioning meetings.
   3. Controls Contractor shall be required to attend additional meetings intended to clarify the controls sequences of operation and reconcile any differences with the design intent. This meeting shall take place after the first Controls sequence of operations is submitted and reviewed.
   4. Provide Commissioning Authority and Test Engineer additional requested data, prior to normal O&M Manual submittal, in a timely manner for the development of the startup plan and the functional performance testing procedures.
   5. During the normal submittal processes, provide an additional copy of all equipment submittals, startup forms, field static testing reports (duct static pressure test reports, pipe static pressure test reports, chemical treatment reports, etc.), and TAB reports to the Commissioning Authority and Test Engineer for review.
   6. Mechanical Contractor shall install pressure/temperature test ports (i.e. - Pete’s plugs) in all piping systems and at all locations where DDC controls pressure and temperature sensors are located.
   7. The Mechanical Prime Contractor shall be responsible for development of a comprehensive startup plan, incorporating the controls contractor point-...
to-point startup plan. The startup plan shall be developed with the help of the Test Engineer in order to integrate startup activities with the Test Engineer’s commissioning plan. Mechanical Sub-Contractors shall assist the Mechanical Prime Contractor in development of the startup plan.

8. The Mechanical Contractor shall provide detailed startup forms and clearly document all completed startup activities. The controls startup forms shall include detailed checkout forms with descriptions for each controlled device. All forms shall be submitted for review by the Test Engineer and Commissioning Authority prior to use.

9. Provide skilled technicians, including equipment vendor representatives, equipment, and materials to perform startup and execute functional performance tests. Controls contractor shall provide skilled technicians, familiar with the project, for both startup (Owner-witnessed point-to-point testing) and functional performance testing. Commissioning functional performance testing participation from the controls contractor shall be required in addition to the point-to-point testing.

10. Correct deficiencies found during startup and functional performance testing in a timely manner to facilitate retesting activities within the commissioning schedule.

11. Submit startup documentation to General Contractor, Test Engineer, and Commissioning Authority to verify functional testing prerequisite requirements are fulfilled before functional testing for the associated equipment or system is scheduled to start. Refer to Section “General Commissioning Requirements,” for commissioning procedure. Startup documentation (point-to-point testing) shall also be required from the controls contractor as a prerequisite to functional performance testing.

12. TAB Contractor shall report any deficiencies found in a timely manner to the Mechanical Contractor. The Mechanical Contractor shall correct these deficiencies in a timely manner to facilitate functional performance testing within the commissioning schedule.

13. TAB Contractor shall coordinate all setpoint value requirements for input into the controls system, including minimum outside air damper positions, return/supply fan VFD speed mapping, pumping loop differential pressure setpoints, duct system static pressure setpoints, air terminal unit flow sensor calibration factors, etc.

14. Maintain and update as-built drawings during construction including controls as-built drawings.

15. Provide final O&M manuals that incorporate all system changes including controls sequence of operations.

16. Providing training, for equipment and systems specified under this section, with coordination by the Contractor and Owner’s Representative

1.2 RELATED WORK

A. Division 23 Section “Commissioning of Mechanical Systems – General Requirements.”

B. Division 23 Section “Commissioning of Mechanical Systems – Functional Performance Testing.”
C. All start-up and testing procedures and documentation requirements specified within Division 23.

D. Cooperate with the Testing, Adjusting and Balancing (TAB) firm in the following manner:
   1. Allow sufficient time before final commissioning dates so that testing, adjusting and balancing can be accomplished.
   2. Put all heating, ventilating, and air conditioning equipment and systems into full operation and continue the operation during each working day of testing, adjusting, balancing and commissioning.
   3. Provide labor and material to make corrections when required, without undue delay.
   4. Include the cost of exchange sheaves and belts as may be required by the TAB firm.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide test equipment as necessary for start-up and commissioning of the mechanical equipment and systems. The TAB firm will provide the test equipment required to perform TAB services.

B. Proprietary test equipment required by the mechanical equipment manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall demonstrate its use and assist the Contractor in the commissioning process.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so each system can be started, tested, adjusted, balanced, and otherwise commissioned. Division 23 has primary start-up responsibilities with obligations to complete systems, including all sub-systems, so they are fully functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.

B. A commissioning plan will be developed by the Test Engineer and approved by the Owner's Representative.
   1. Division 23 shall be obligated to assist the Test Engineer in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation, identification of parties responsible for startup activities, and schedule dates for equipment startup activities.
2. If system modifications/clarifications are called for in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.

3. If Contractor-initiated system changes have been made that alter the commissioning process, the Contractor will notify the Owner’s Representative for approval.

3.2 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start up all systems within Division 23.
   1. These same technicians shall be made available to assist the Contractor and Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty.
   2. Work schedules, time required for testing, etc., will be requested and coordinated by the Contractor.
   3. Division 23 will ensure that qualified technician(s) are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustment, and problem resolutions.

B. System problems and discrepancies may require additional technician time which shall be made available for the subsequent commissioning periods until required system performance is obtained.

C. The Owner's Representative reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Such qualifications include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Contractor to get the job done.

3.3 WORK TO RESOLVE DEFICIENCIES

A. In some systems, mis-adjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Owner's Representative and the Architect, with input from the Contractor and equipment supplier. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Architect will have final jurisdiction on the work needed to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process.
   1. Experimentation to render system performance will be permitted.
      a. If the Architect deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Architect will notify the Owner indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities.
b. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem.

c. Costs incurred to solve the problem in an expeditious manner will be the Contractor’s responsibility.

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall.

1. Initial commissioning will be done as soon as contract work is completed regardless of season.

2. Commissioning under conditions representing other than the current season may be undertaken at a later time by the Test Engineer and Commissioning Authority.

3. Discrepancies discovered with the Contractor’s equipment or workmanship will be handled as warranty items.

3.5 RETESTING AND RECOMMISSIONING

A. Any fault in material or in any part of the installation revealed by commissioning tests shall be investigated, replaced, or repaired by the Contractor, and the same test repeated at the Contractor’s expense until no fault appears.

3.6 TRAINING

A. Participate in the training of the Owner’s engineering and maintenance staff, as required in Divisions 01 and 23, on each system and related components. Training, in part, will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.

B. Training shall be conducted jointly by the Contractor, the Design Engineers, and the equipment vendors. The Contractor will be responsible for highlighting system peculiarities specific to this project.

3.7 MISCELLANEOUS SUPPORT

A. Division 23 shall remove and replace covers of mechanical equipment, open access panels, etc., to permit Contractor, Architect and Owner’s Representative to observe equipment and controllers provided. Furnish ladders and flashlights as necessary.

END OF SECTION 23 08 16
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Division 01 Section "Commissioning."
   2. Division 23 Section “Common Work Results for HVAC”
   3. Division 23 Section “Identification for Mechanical Piping and Equipment”
   4. Division 23 Section “Condensate Piping.”
   5. Division 23 Section “Split-System Air-Conditioners.”
   6. Division 23 Section “Air Duct Accessories.”
   7. Division 23 Section “Unit and Cabinet Heaters.”
   8. Division 23 Section “Testing, Adjusting, and Balancing.”
   9. Division 23 Section “Commissioning of Mechanical Systems: General Requirements.”
   10. Division 16 “Electrical”

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems, including control components, wiring and piping for equipment. Control system consists of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories connected to controllers to operate systems according to sequences of operation indicated. System Software shall be updated to the latest version at project completion.

B. \n
1.3 SUBMITTALS

A. General: See Division 23 Section “Common Mechanical Materials and Methods” for general requirements of Product Data, Shop Drawings, Reports and Certificates, and Operation and Maintenance data submittals.

   1. Product Data: Include manufacturer's technical Product Data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, installation instructions, and startup instructions. Hardware: Include technical data for workstations, controllers, transducers/transmitters, sensors, actuators, and components.

   2. Software: Include technical data for operating system software, operator interface, graphics, and other third party applications.
B. Shop Drawings (AutoCAD 2006, AutoCAD 14 or latest version) from manufacturer detailing equipment assemblies, indicating dimensions, weights, loadings, required clearances, and methods of field assembly, components, and location and size of each field connection. Include the following:

1. Schematic flow diagram for each system type showing fans, pumps, boilers, chillers, coils, dampers, valves, and control devices.
2. Each control device labeled with setting or adjustable range of control.
3. Diagrams for all required electrical wiring. Clearly differentiate between factory-installed and field-installed wiring. Label/tag all field installed wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Detailed written description of control sequence of operation.
6. Listing of connected data points, including connected control unit and input device.
7. Sample of color system graphics diagrams indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
8. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

C. Schedules: Valve schedules identifying valve size, fail-safe position, flow, Cv, actual pressure drop and equipment served. Damper schedules identifying damper size, fail-safe position, pressure drop and equipment served.

D. Field Quality Control and Testing: Test Plans forms which will be used to verify operation of all points and control functions.

E. Certificates: Data Communication Protocol.

1.4 COORDINATION

A. Ensure installation of components is complementary to installation of similar components in other systems.

B. Coordinate installation of control wiring and piping requirements with installation of mechanical systems equipment.

C. Coordinate installation of components (dampers, valves, flow measurement, meters, etc) provided under this section and to be installed by other sections.

D. Ensure each system is completed calibrated, tested and operational prior to commissioning. Coordinate and provide support for Pre-Functional and Functional Performance Testing.

E. Coordinate and support test/balance contractor for all balancing requirements.

F. Coordinate and provide compatible components for interface with equipment being furnished.
1.5 OPERATION AND MAINTENANCE DATA

A. Maintenance data for control systems equipment to include in the operation and maintenance manual specified in Division 23 Section “Common Mechanical Materials and Methods.” Include the following:

1. Maintenance instructions and spare parts list (including unit cost) for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

B. Project Record Documents:

1. Accurately record actual location of control components, including panels, controllers, thermostats, and sensors.
2. Shop drawings reflecting actual installation and operating sequences.
3. Include data specified in "Submittals" in final form.
4. System software flow chart reflecting operating sequences.
5. Documented results of Field Quality Control and Testing Plan.
6. Certificate stating that control systems have been tested and adjusted for proper operation.
7. Software License Agreements

1.6 QUALITY ASSURANCE

A. Comply with the latest edition of the following codes, regulations and standards:

1. City, county, state and federal regulations and codes including amendments
5. Underwriters Laboratories UL 864 “Smoke Control System Equipment.”
8. ANSI/ASHRAE Standard 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
9. BACnet Testing Laboratories (BTL): Devices and products utilized in the BACnet interface shall be BTL listed and label.
1.7 SERVICE AND GUARANTEE

A. After completion of the system, including software, submit a warranty in accordance with Division 01. Provide all services, materials and equipment necessary for the successful operation of the hardware and controls during the warranty period. Preventive maintenance shall be included. Software and data shall be revised and updated as necessary during warranty period to maintain system performance.

B. During the warranty period provide a 24-hour emergency service number where a qualified automation service technician familiar with the installed system may be reached. This service technician shall have the capability of remotely communicating with the system for troubleshooting and program alterations.

C. Provide inspection for opposite season to test, calibrate, and adjust controls. Submit written report for each inspection.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store equipment and materials inside and protected from weather.

B. Factory Mounted Controls: Where Factory-Mounted Controls are indicated to be factory mounted on equipment, arrange for shipping, packing and labeling of control devices to the equipment manufacturer. Installation requirements, wiring schematics shall be furnished and coordinated directly with respective unit manufacturer. Unless otherwise indicated, all cost associated with factory-mounted controls and wiring shall be included under this section.

1.9 EXTRA MATERIALS

A. Furnish spare materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents. Spare materials used during warranty shall be replaced.

B. Spare Parts: As a minimum, provide the following spare parts:

1. Space Temperature Sensors with covers: 5 percent of the installed system or minimum quantity of 3.
2. Duct and Pipe Temperature Sensors: 5 percent of the installed system or minimum quantity of 2 of each type.
3. Replacement Materials: Provide one replacement diaphragm or relay mechanism for each unique pneumatic damper motor, valve motor, controller, thermostat, and positioning relay.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Approved Manufacturers / Representatives:
   a. Alerton / ATS Automation.
   b. TAC Invensys / Control Contractors, Inc.
   c. Delta / ECS Automation
   d. Johnson Controls / Johnson Controls, Inc.
   e. Siemens / Siemens Building Technologies, Inc.
   f. Trane (Tracer Summit) / Trane Company

2. Manufacturers Qualifications: A minimum of 5 (equivalent size and complexity of this project) operational systems within the last 5 years utilizing similar components located in the same State or within 100 miles of project site. Manufacturer or authorized manufacturer’s on-site service support shall also be available within the same location parameters indicated.

3. Technician Qualifications: Direct employee of manufacturer of primary control system with a minimum of 5 years of experience for systems programming, startup, trouble-shooting and diagnostics.

4. Installer Qualifications: By the District Office of the manufacturer as a subcontract, or by a firm regularly engaged in the installation of building direct digital HVAC control systems for a period of not less than 5 years. The entire control system shall be installed by qualified electricians and mechanics, all of which are properly trained and qualified for the work they perform, and directly supervised by the local representative of the component manufacturer.

B. Provide NEMA enclosure rated for installed conditions. A local disconnect shall be provided at each controller to individually disconnect control power without interruption to any other controller.

2.2 APPLICATION SPECIFIC CONTROLLERS

A. Application Specific Controllers shall be fully programmable or pre-programmed to support, but not be limited to, the control of the following configurations of Unitary equipment to address current requirements as described in the sequence of operation, and for future expansion. Controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally stand-alone fashion. Application programs and parameter data shall be stored in nonvolatile memory:

2. Fan Coils and Air Conditioning Units.
3. Cabinet Heaters, Unit Heaters, Convectors and Radiators.

B. The modes of operation supported by the Controllers shall include, but not be limited to, the following:

1. Day/Weekly Schedule.
2. Comfort/Occupancy Mode.
3. Economy Mode (Standby Mode, Unoccupied, etc.).
4. Temporary Override Mode.

C. Provide NEMA enclosure rated for installed location. A local disconnect shall be provided at each Application Specific controller to individually disconnect control power without interruption to any other digital controller.

2.3 SURGE PROTECTION

A. Provide Surge and transient protection consisting of devices installed externally to digital controllers and operator workstations.

B. Power Line Surge Protection Surge suppressers external to digital controller, shall be installed on all incoming AC power. Surge suppresser shall be rated by UL 1449, and have clamping voltage ratings below the following levels:


2.4 WIRING

A. Provide complete electric wiring for temperature control apparatus, including transformer primaries. Control circuit conductors, which run in the same conduit as power circuit conductors, shall have the same insulation level as power circuit conductors.

B. AC Control Wiring

1. Control wiring for 24 V circuits shall be insulated copper 18 AWG minimum and shall be rated for 300 VAC service.
2. Wiring for 120 VAC shall be 14 AWG minimum and shall be rated for 600 VAC service.

C.

2.5 CONTROL COMPONENTS

A. Temperature Sensors:

1. Duct or Pipe Temperature sensors shall be nickel or platinum type RTD's, factory calibrated within plus or minus 0.1 degrees F.
2. Use insertion elements in ducts not effected by temperature stratification. Use averaging elements in duct prone to stratification with length at least the widest dimension of the duct cross section.

3. Insertion elements for liquids shall be stainless steel encased and matched with the temperature wells installed with a minimum insertion length of 2-1/2 inches.

4. Provide outside air temperature sensors with watertight inlet fitting, shielded from direct rays of sun.

5. Room Temperature Sensors: Analog or thermistor type complete with mounting bracket and cover. Each room temperature sensor shall be provided with an integral terminal jack for laptop or portable operators terminal interface and with the following:
   a. **Blank Cover.**
   b. **LCD Display.**
   c. **Temperature Set point Adjustment.**
   d. **Override Timer Pushbutton.**

6. Room sensors located in areas subjected to damage shall be provided with protective guard.

B. **Spans and Ranges:**

1. **Temperature:**
   a. 50 degrees F span: Room, chilled water, cooling coil discharge air, return air sensors.
   b. 100 degrees F span: Outside air, hot water, heating coil discharge air, mixed air sensors.
   c. 200 degrees F span: High temperature hot water, heating hot water, chilled/hot water system sensors.

2. **Pressure:**
   a. **-0.25 to .25** inches of water differential range: Static pressure of rooms.
   b. **0 to 2** inches of water differential range: Duct static pressure.

3. **Humidity:**
   a. 0-100 percent relative humidity.

C. Differential Static Pressure Sensors/Transmitters: Integral pressure transducer and transmitter. Output of pressure instrument shall be 4-20 mA signal proportional to the pressure span. Accuracy shall be 1.0-percent, linearity shall be 0.1-percent. Supply voltage shall be 24 V. Unidirectional with range not exceeding 150-percent of maximum expected input.

D. Dynamic Pressure Sensors/Transmitters:
   1. UL listed, microprocessor based with flash memory, bidirectional or unidirectional dynamic pressure and airflow measurement assembly. Complete with sensor, transmitter, enclosure, mounting kit and UL plenum rated cabling. Installed accu-
racy shall be 2-percent airflow (0-3000 cfm FPM), 4-percent dynamic pressure (+0.5 in w.g.) and repeatability shall be ±0.25-percent of reading. Sensor assembly shall consist of hermetically sealed thermistors in weather-proof housing. Transmitter output shall be fused, isolated and linear (4-20 mA or 0-10 VDC). 12 bit A/D converter with 0.1-percent output resolution.

2. **Coordinate with Division 23 Section “Air Duct Accessories” for installation provisions.**


**E. Relative Humidity Transmitters:** Integral humidity transducer and transmitter. Output of relative humidity instrument shall be a 4 to 20 milliampere signal proportional to 0 to 100 percent relative humidity input. Accuracy shall be 2 percent of full scale within the range 20 to 80 percent relative humidity. Sensing element shall be chilled mirror type, polymer, or thin film polymer type. Supply voltage shall be 24 V dc.

**F. Actuators:** Provide for all motor-operated dampers, valves and AHU Fan Flow Control Device of sufficient size and type, matched to application and operating temperature/pressures.

1. **Electric or Electronic Actuators:** Solid state positioner to stop automatically at end of travel. Complete with permanently lubricated gear train. Provide proportional, or 2-position (with adjustable SPDT auxiliary end-switch) actuators. Provide with spring return to normally-open or normally-closed on loss of control power. Power return type actuators shall not be acceptable. Substitution for 3-point floating type actuators suitable for pulse width modulation control in lieu of analog type actuators shall be permitted only for Terminal Units, Unit Heaters, Fan Coil Units, Cabinet Heaters, Finned Tube Radiation, and Convecrors. Use of non-analog type actuators for any other applications shall not be allowed without prior approval.

**G. Control Dampers:** Low leakage control dampers where not furnished with package units. Damper leakage rate shall not exceed 0.5 percent (of damper based on 2000 fpm duct velocity) when closed against 4-inch water gage static pressure; complete with extruded aluminum, stainless steel or zinc-coated steel blades, with extruded vinyl or rubber edge seals: blade ends sealed with aluminum or stainless steel "arc" seals. External frame of heavy gage welded steel with 1/4-inch plate bearing bars and bronze insert bearings. **Coordinate with Division 23 Section “Air Duct Accessories” for installation provisions.**

**H. Control Panels:** Panels shall be UL listed, NEMA type rated for application and location, surface or flush mounted panel as indicated with key locked door with continuous hinge and standard baked enamel finish.

**I. Differential Pressure Switches:**

1. **Filter Status:** Diaphragm operated which actuate a SPDT snap action switch. A field adjustable pressure set point with a range suitable for air flow status applications. The switch voltage and current rating shall be double the load requirements. Provide sensing tubes connected to tips with multiple holes and bulkhead
fittings specifically designed for air flow sensing. Manufacturer: Dwyer or approved equal.

2. Air System - Limit Differential Pressure Switch: Pressure switches shall incorporate gauge and switch point indicator(s) for continuous indication of applied pressure and switch settings. Diaphragm operated with switching accomplished by photocell controlled relays. Set point adjustment controlled by knobs. Complete with set point latching circuit and external push-button switch for manual reset. Range 0-2 inches water gauge. Manufacturer: Dwyer or approved equal.

3.

J. Current Transmitters: Designed to convert monitored AC current to a proportional DC voltage of 0-10 VDC or 4-20 mA output. Range 1 to 10, 50, 100 amps as required. Accuracy 1-percent of full scale. Repeatability plus or minus 2-percent of full scale. Response time 100 milliseconds.

K. Current Sensing Relay: 100-percent solid state with adjustable range (+/- 1-percent of range) trip set point to monitor AC current. Provide with contact transfer with no calibration drift, complete with LED status indicator. Limit off-state leakage to 2 mA or less. Rating (200 ampere minimum) shall exceed equipment being monitored.

L. Control Relays: Relays shall be rated for the application, with a minimum of two sets of Form C contacts, enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays should be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

M. Low Limit Thermostats: DPDT, incremental bulb type; actuates if any 12-inch maximum increment is below its setting; adjustable setting, manual reset. Provide capillary element length of 2.14 equaling 2.14 square feet of coil area per foot capillary element. One DPDT contact shall shut down equipment.

N. Contactors: Single coil electrically operated. Contacts shall be double break silver to silver. Number of contacts and rating shall be selected for the application intended. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

O. Transformers: Transformers shall conformance to UL 506. Class 2 current limiting type or over-current protection. Connected load shall be limited to 80-percent of transformer rated capacity.

P. Nameplates: Nameplates shall be in accordance with Division 23 Section “Identification for Mechanical Piping and Equipment.”

2.6 FLOW MEASUREMENT

A. Air Measuring Unit (AMU):
1. Air measuring unit (AMU) assembly shall be UL listed, true averaging, independent multi-point sensing type, and microprocessor (digital circuitry with FLASH memory) transmitter with 16-character LCD display. Factory calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST). Probes shall be configured to suit installed locations (duct and/or fan inlet). Vortex shedding arrays, pitot tubes, RTD, differential pressure sensing arrays and auto-zeroing sensors are not acceptable.

2. Airflow and Temperature Measurement: Hermetically sealed thermistors mounted in the assembly with marine grade waterproof epoxy. Wiring shall be UL plenum rated, Kynar coated and installed within probe with no exposed wiring to environment. Airflow rate and temperature data of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output.

3. Airflow accuracy shall be ±0.2% over entire operating airflow range. Temperature accuracy shall be ±0.15 F over operating temperature range of –20 F to 160 F. Operating humidity range shall be 0-99% RH (non-condensing)

4. Probes: Gold anodized or stainless steel tube suitable for operating environment complete with mounting brackets and installation hardware.

5. Linear analog, 0-10VDC/4-20mA isolated allowed.

6. Coordinate with Division 23 Section “Air Duct Accessories” for installation provisions.

7. Manufacturers:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the Owner Representative in writing of conditions detrimental to the proper and timely completion of the work.

3.2 INSTALLATION (GENERAL)

A. Install in accordance with manufacturer's instructions.

B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to insure a complete operating system in accordance with the sequences of operation and point schedules.
3.3 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, mount 60-inches (panels measured from top edge) above floor with minimum 3'-0" clear access space in front of units.

B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration and high temperature.

C. Identification: Provide permanently mounted tags to all instruments with point address designation, system reference and description. Label all wiring, tubing at each end to match control diagrams.

D. Control Panels

1. Provide for controls and instruments at equipment and in mechanical room.
2. Install temperature gages and pilot lights flush on the cabinet door. Install controllers, switches, timers, transformers, and relays in the interior of the cabinet; mount on a steel or aluminum subpanel or on the back panel of the cabinet. Provide and label control parameters and test points within the panel for total evaluation of system operation. Electrical controls shall be wired to numbered screw type terminal strips.

E. Temperature Sensors: Provide temperature sensors in locations to sense the appropriate condition. Provide sensor where they are easy to access and service without special tools. Calibrate sensors to accuracy specified. In no case will sensors designed for one application be installed for another application.

1. Room Temperature Sensors: Provide on interior walls to sense average room temperature conditions. Avoid locations which may be covered by office furniture. Room temperature sensors should not be mounted on exterior walls when other locations are available. Unless otherwise indicated, mount centerline of sensor at 5 feet above finished floor.
2. Duct Temperature Sensors:
   a. Select specific sensor location within duct to accurately sense appropriate air temperatures. Do not locate sensors in dead air spaces or positions obstructed by ducts or equipment. Install gaskets between the sensor housing and duct wall. Seal duct and insulation penetrations.
   b. Install duct averaging sensors, freeze protection sensors, between two rigid supports in a serpentine position to sense average conditions. Thermally isolate temperature-sensing elements from supports. Provide duct access doors to averaging sensors.
3. Immersion Temperature Sensors: Provide thermowells for sensors measuring temperatures in liquid applications or pressure vessels. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to effect proper flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of the pipe area. Increase piping size as
required to avoid restriction. Provide thermowells with thermal transmission material within the well to speed the response of temperature measurement. Provide wells with sealing nuts to contain the thermal transmission material.

4. Outside Air Temperature Sensors: Provide outside air temperature sensor on north side of the building, away from exhaust hoods, air intakes and other areas that may affect temperature readings. Provide sunshields to protect outside air sensor from direct sunlight.

F. Damper Actuators: Actuators shall not be mounted in the air stream.

G. Pressure Sensors:
   1. General: Install pressure sensing tips in locations to sense appropriate pressure conditions.
   2. Duct Static Pressure Sensing: Unless otherwise indicated, locate duct static pressure tip approximately two-thirds of distance from supply fan to end of duct with the greatest pressure drop.
   4. Steam Pressure Sensing: Install snubbers and isolation valves on steam pressure sensing applications.

H. Flow Measurement: Install and locate per manufacturer’s instructions.

3.4 CONTROL WIRING AND CONDUIT

A. All control wiring, all conduit for control wiring, and all miscellaneous accessory equipment for control wiring systems shall be provided by the Control Subcontractor as part of the control system. Conform to Division 26 requirements, NFPA 70, and all local code requirements.

B. All wiring in or through mechanical, electrical rooms, finished spaces, on roofs, in walls, below grade and inside equipment (except within control wiring compartments or control panels) shall be installed in conduit and properly supported. Label wire groups to match corresponding wiring diagrams.

C. Plenum Cable: Plenum cable type, installation methods and use shall be subject to City and State Codes and Regulations. Within ceiling space, attach directly to wall or slab on 4-foot centers, or support from ceiling suspension wires on 4-foot centers. Do not attach cables to pipes or ducts, or lay on ceilings. Cables shall be routed as high as possible without interference to equipment, ceiling, lighting access and removal.

D. Instrumentation and communication cable shall not be run together in the same conduit or raceway as power wiring.

E. Network Communications: Coordinate with Owner for Internet, Ethernet availability, connection regulations and restrictions.
F. Grounding: Ground controllers and cabinets to a good earth ground. Grounding of the green AC ground wire, at the breaker panel, alone is not adequate. Run metal conduit from controller panels to adequate building grounds. Ground sensor drain wire shields at controller end. All associated ground loop problems shall be corrected.

G. Provide interface control wiring for equipment with remote sensors, panels, limits, and components, etc., furnished (shipped loose) by the manufacturer and to be field installed. Materials, wiring and termination shall be provided and installed in accordance with manufacturer's instruction, including, but not limited to the following:
1. Indoor/Outdoor Split Unit: Evaporation/condenser sections.

3.5 FIELD QUALITY CONTROL AND TESTING

A. Demonstrate compliance of the HVAC control system with the contract documents. Calibrate instrumentation and controls and verify the specified accuracy using calibrated test equipment. Adjust controls and equipment to maintain conditions indicated, to perform functions indicated, and to operate in the sequence specified. Furnish personnel, equipment, instrumentation, and supplies necessary to perform calibration and site testing. Calibrate field equipment and verify equipment and system operation before placing the system on-line. Field-testing will be witnessed by the Owner, Owner's representative or Commissioning Agent and shall include the following:

1. System Inspection: Observe the HVAC system in its shutdown condition. Provide end-to-end wiring checkout. Check dampers and valves for proper normal positions. Document each position for the test report.

2. Calibration Accuracy and Operation of Inputs Test: Check for proper calibration and operation of each input instrument. For each sensor (temperature), record the reading at the sensor, and using traceable test equipment, and record the reading at the digital controller. Document each reading for the test report.

3. Operation of Outputs Test: Check the operation of each output to verify correct operation. Command analog outputs to minimum range, such as 4 mA, and maximum range, such as 20 mA, measure and record commanded and actual output values. Document each command and result for the test report.

4. Actuator Range Adjustment Test: With the digital controller, apply a control signal to each actuator and verify that the actuator operates properly from its normal position to full range of stroke position. Record actual spring ranges and normal positions for all modulating control valves and dampers. Include documentation in the test report.

5. Digital Controller Start-up and Memory Test: Demonstrate that programming is not lost after a power failure, and digital controllers automatically resume proper control after a power failure.

6. Surge Protection: Show that surge protection, meeting the requirements of this specification, has been installed on incoming power to the digital controllers and on communication lines.

7. Application Software Operation Test: Test compliance of the application for:
   a. Ability to communicate with the digital controllers, uploading and downloading of programs
b. Text editing program: Demonstrate the ability to edit the control program off line.

c. Reporting of alarm conditions: Cause alarm conditions for each alarm, and ensure that workstation receives alarms.

d. Reporting trend and status reports: Demonstrate ability of software to receive and save trend and status reports.

e. Execution of Sequence of Operation: Furnish graphic trends to show the sequence of operation is executed in correct order. Demonstrate the HVAC system operates properly through the complete sequence of operation, for example seasonal, optimal start/warm-up, and occupied/unoccupied modes of operation. Demonstrate proper control system response for abnormal conditions for which there is a specified response by simulating these conditions. Demonstrate hardware interlocks and safety work. Demonstrate the control system performs the correct sequence of control after a loss of power.

f. Control Loop Stability and Accuracy: Furnish graphic trends of control loops to demonstrate the control loop is stable and that set point is maintained. Control loop response shall respond to set point changes and stabilize within 1 minute.

g. Opposite Season Test: Testing shall be repeated for opposite season.

B. Document all tests with detailed results. Provide statement that all corrective action taken. Include test report in Operation and Maintenance Manuals.

3.6 TRAINING

A. Upon substantial completion of the mechanical system work, furnish the services of a competent technician regularly employed by the controls manufacturer for the instruction of facility personnel in the operation and maintenance of each system at project site. Provide a minimum of 40 hours for training. Coordinate with Owner for number of personnel, date, time, and location. Multiple training times may be necessary to accommodate different working shifts.

B. Furnish a written test plan and training schedule for approval 15 days prior to instructing operating personnel including the following:

1. Recommended training schedule for operators workstation, standalone controllers, Application specific digital controllers and field components.
2. List of all training materials, aids, etc.
3. List of customer training schools offered by the manufacturer.

C. Provide all training and materials necessary for each facility personnel, including:

2. As-Built control diagrams
3. Detailed description of the system
4. Complete listing, graphical logic diagrams of all software programs required to perform the sequence of operation.
5. Commands, operating and trouble shooting instruction and routine maintenance procedures.
6. Theory of operations
7. Hardware architecture
8. Operation of system
9. Operator Commands
10. Control sequence programming
11. Data base entry
12. Reports and logs
13. Alarm reports
15. Physical layout of each piece of hardware
16. Troubleshooting and diagnostics procedures
17. Repair instructions
18. Preventive maintenance procedures and schedules

D. Provide 8 hours of additional training 3 and 6 months after project completion. Training to address specific topics that the facility personnel need to discuss and to answer questions concerning operation of the system.

PART 4 - SEQUENCE OF OPERATION AND POINT LIST

A. Sequence of operations and point list are indicated on drawings.

B. Controls shall be by local controls.

C. Operating schedules shall be confirmed with Owner and adjusted as necessary

D. Additional points shall be provided to execute the sequence of operations.

END OF SECTION 23 09 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 23 Section "Common Mechanical Materials and Methods" for general piping materials and installation methods.
   2. Division 23 Section "General-Duty Valves for Mechanical Piping" for general-duty gate, globe, ball, and check valves applicable to this Section.
   3. Division 23 Section "Hangers and Supports for Mechanical Piping and Equipment" for pipe supports and seismic restraints.
   4. Division 23 Section "Identification for Mechanical Piping and Equipment" for labeling and identifying piping systems.

1.2 SUMMARY

A. This Section includes condensate piping.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data including rated capacities where applicable, furnished options and accessories, and installation instructions for safety relief valves, pressure-reducing valves, and steam traps.

C. Shop Drawings: Provide the following:
   1. Plan layout drawings of all piping systems covered under this section. Drawings shall be 1/4-inch = 1'-0" scale and indicate location of all equipment, pipe, fittings, valves, supports and accessories. Drawings shall include dimensions, weights, loading at each support point, required clearances for equipment service and location and size of each field connection.
   2. Details of pipe supports, anchors, expansion joints, and equipment connections.

D. Maintenance data for condensate specialties and special-duty valves to include in the operation and maintenance manual specified in Division 01.
1. Field test reports indicating and interpreting test results relative to compliance with specified requirements.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with the following provisions:

1. ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
2. Welding Standards: Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications."

1.5 COORDINATION

A. Coordinate layout and installation of piping with condensate equipment and with other installations.
B. Coordinate pipe sleeve installation for foundation wall penetrations.
C. Coordinate installation of equipment and pipe supports.
D. Coordinate pipe fitting pressure classes with products specified in related Sections.
E. Coordinate size and location of concrete housekeeping pads. Cast anchor-bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 03 Sections.
F. Coordinate installation of pipe sleeves for penetrations in exterior walls and floor assemblies.

2.1 PIPE MATERIALS

A. General: Refer to Part 3 pipe application articles for identifying where the following materials are used.
B. COPPER TUBE AND FITTINGS
   1. Drawn-Temper Copper Tube: ASTM B88, Type L.

2.2 FITTINGS

A. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300.
   1. Copper Tube, Push-on-Joint Fittings:
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:
   b. Apollo Flow Controls; Conbraco Industries, Inc.
   c. Elkhart Products Corporation.
   d. NIBCO INC.
   e. Victaulic Company.

2. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials:
   1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
   2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.
   Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 PIPE ANCHORS

A. Pipe anchors constructed from ASTM A36 structural steel shapes and plate. Anchors shall be designed by a licensed Structural Engineer for the forces and moments indicated on the drawings.

PART 3 - EXECUTION

3.1 PIPE APPLICATIONS LESS THAN 15 PSIG

A. Condensate Piping, 2-Inch NPS and Smaller: Type L copper pipe.
3.2 PIPING INSTALLATIONS

A. Install piping according to Division 23 Section "Common Work Results for HVAC."

B. Locate groups of pipes parallel to each other.

C. Install condensate drain piping at a uniform slope of 1/8 inch per foot minimum in the direction of flow.

D. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

E. Install pipe anchors where indicated and where required to ensure proper pipe expansion and contraction.

3.3 TERMINAL EQUIPMENT CONNECTIONS

Piping size for condensate drain shall be same size as equipment connections at the drain pan.

3.4 HANGERS AND SUPPORTS

A. General: Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for Mechanical Piping and Equipment." Conform to requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
2. Adjustable roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal runs 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

C. Install hangers for steel piping with the following minimum rod sizes and maximum spacing:

<table>
<thead>
<tr>
<th>Nom. Pipe Size (Inches)</th>
<th>Steel Pipe Max. Span (Feet)</th>
<th>Min. Rod Diameter (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 3/4</td>
<td>7</td>
<td>1/4</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>1/4</td>
</tr>
<tr>
<td>1-1/4</td>
<td>7</td>
<td>3/8</td>
</tr>
<tr>
<td>1-1/2</td>
<td>9</td>
<td>3/8</td>
</tr>
</tbody>
</table>
3.5 PIPE JOINT CONSTRUCTION

A. Refer to Division 23 Section Common Work Results for HVAC for joint construction requirements for threaded, welded, and flanged joints.

3.6 FIELD QUALITY CONTROL

A. Testing Preparation: Prepare steam and condensate piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Flush system with clean water.

B. Testing: Test condensate piping as follows:

1. Notify Owner or Owner’s Representative a minimum of 10 working days prior to testing. Test to be witnessed by Owner or Owner’s Representative.
2. Use ambient temperature water as testing medium, except where there is risk of damage due to freezing. Another liquid may be used if it is safe for workers and compatible with piping system components.
3. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test.
4. 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 as appropriate, and repeat hydrostatic test until there are no leaks.
5. Prepare written report of testing.

END OF SECTION 23 22 13
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Division 07 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
   2. Division 23 Section "Hangers and Supports for Mechanical Piping and Equipment" for pipe supports and installation requirements.
   3. Division 23 Section "Identification for Mechanical Piping and Equipment" for labeling and identifying refrigerant piping.
   4. Division 23 Section "Instrumentation and Control for HVAC" for thermostats, controllers, automatic-control valves, and sensors.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.

   1. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals specified in Division 01.
1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX; "Welding and Brazing Qualifications."


C. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."

D. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.5 COORDINATION

A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

D. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 07 Section "Penetration Firestopping" for materials and methods for sealing pipe penetrations through fire and smoke barriers.

E. Coordinate pipe fitting pressure classes with products specified in related Sections.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Refrigeration Oil Test Kits: Two each, containing everything required to conduct one test.

2. Refrigerant: Two containers each, with 20 lb of refrigerant.

3. Filter-Dryer Cartridges: Three of each type.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Refrigerants:
   a. Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.
   b. DuPont Company; Fluorochemicals Div.
   d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.

2. Refrigerant Valves and Specialties:
   a. Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
   b. Danfoss Electronics, Inc.
   c. Emerson Electric Company; Alco Controls Div.
   d. Henry Valve Company.
   e. Sporlan Valve Company.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

E. Flexible Connectors: 500-psig (3450-kPa) minimum operating pressure; seamless tin-bronze core, high-tensile bronze-braid covering, and solder-joint end connections; dehydrated, pressure tested, minimum 7 inches long

2.3 VALVES

A. Diaphragm Packless Valves: 500-psig working pressure and 275 deg F working temperature; globe design with straight-through or angle pattern; forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, and with solder-end connections.
B. Packed-Angle Valves: 500-psig working pressure and 275 deg F working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.

C. Check Valves Smaller Than NPS 1: 400-psig operating pressure and 285 deg F operating temperature; cast-brass body, with removable piston, polytetrafluoroethylene seat, and stainless-steel spring; globe design. Valve shall be straight-through pattern, with solder-end connections.

D. Check Valves, NPS 1 and Larger: 400-psig operating pressure and 285 deg F operating temperature; cast-bronze body, with cast-bronze or forged-brass bolted bonnet; floating piston with mechanically retained polytetrafluoroethylene seat disc. Valve shall be straight-through or angle pattern, with solder-end connections.

E. Service Valves: 500-psig pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.

F. Solenoid Valves: Comply with ARI 760; 250 deg F temperature rating and 400-psig working pressure; forged brass, with polytetrafluoroethylene valve seat, 2-way, straight-through pattern, and solder-end connections; manual operator; fitted with suitable NEMA 250 enclosure of type required by location, with 1/2-inch conduit adapter and 24 V, normally closed holding coil.

G. Pressure-Regulating Valves: Comply with ARI 770; pilot operated, forged brass or cast bronze, stainless-steel bottom spring, pressure-gage tappings, 24-V dc standard coil, and wrought-copper fittings for solder-end connections; suitable for refrigerant specified.

H. Pressure-Regulating Valves: Comply with ARI 770; direct acting, brass; with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connection; suitable for refrigerant specified.

I. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.

J. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

K. Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.

2.4 REFRIGERANT PIPING SPECIALTIES

A. Straight- or Angle-Type Strainers: 500-psig working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in
liquid lines up to 1-1/8 inches, 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.

B. Moisture/Liquid Indicators: 500-psig maximum working pressure and 200 deg F operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

C. Replaceable-Core Filter-Dryers: 500-psig maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:

1. Filter Cartridge: Pleated media with integral end rings, stainless-steel support, ARI 730 rated for capacity.
2. Filter-Dryer Cartridge: Pleated media with solid-core sieve with activated alumina, ARI 730 rated for capacity.

D. Permanent Filter-Dryer: 350-psig maximum operating pressure and 225 deg F maximum operating temperature; steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

E. Mufflers: 500-psig operating pressure, welded-steel construction with fusible plug; sized for refrigeration capacity.

2.5 RECEIVERS

A. Receivers, 6-Inch Diameter and Smaller: ARI 495, UL listed, steel, brazed, 400-psig pressure rating, with tappings for inlet, outlet, and pressure relief valve.

B. Receivers Larger Than 6-Inch Diameter: ARI 495, welded steel, tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII; 400-psig pressure rating, with tappings for liquid inlet and outlet valves, pressure relief valve, and liquid-level indicator.

2.6 REFRIGERANTS

A. ASHRAE 34, R-123: Dichlorotrifluoroethane.

B. ASHRAE 34, R-134a: Tetrafluoroethane.

C. ASHRAE 34, R-22: Monochlorodifluoromethane.

D. ASHRAE 34, R-500: Azeotrope.
PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Aboveground, within Building: **Type ACR drawn-copper tubing.**

B. Belowground for NPS 2 and Smaller: **Type L annealed-copper tubing.**

3.2 VALVE APPLICATIONS

A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor, for gage taps at hot-gas bypass regulators, on each side of strainers.

B. Install check valves in compressor discharge lines and in condenser liquid lines on multiple condenser systems.

C. Install packed-angle valve in liquid line between receiver shutoff valve and thermostatic expansion valve for system charging.

D. Install diaphragm packless or packed-angle valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.

E. Install a full-sized, three-valve bypass around each dryer.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve.
   1. Install solenoid valves in horizontal lines with coil at top.
   2. Electrical wiring for solenoid valves is specified in Division 26 Sections. Coordinate electrical requirements and connections.

G. Install thermostatic expansion valves as close as possible to evaporator.
   1. If refrigerant distributors are used, install them directly on expansion-valve outlet.
   2. Install valve so diaphragm case is warmer than bulb.
   3. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
   4. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install pressure-regulating and pressure relief valves as required by ASHRAE 15. Pipe pressure relief valve discharge to outside.

3.3 SPECIALTY APPLICATIONS

A. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.
B. Install strainers immediately upstream from each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.

C. Install strainers in main liquid line where multiple expansion valves with integral strainers are used.

D. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

E. Install pressure relief valves on ASME receivers; pipe discharge to outdoors.

F. Install replaceable-core filter-dryers in vertical liquid line adjacent to receivers and before each solenoid valve.

G. Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.

H. Install solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

I. Install receivers, sized to accommodate pump-down charge, on systems 5 tons and larger and on systems with long piping runs.

J. Install flexible connectors at or near compressors.

3.4 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Basic piping installation requirements are specified in Division 23 Section "Common Mechanical Materials and Methods."

C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

F. Belowground, install copper tubing in protective conduit. Vent conduit outdoors.

G. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
H. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps and double risers to entrain oil in vertical runs.
   4. Liquid lines may be installed level.

I. Install bypass around moisture-liquid indicators in lines larger than NPS 2.

J. Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.

K. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

L. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for Mechanical Piping and Equipment."

M. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
   2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
   3. Pipe rollers for multiple horizontal runs 20 feet or longer, supported by a trapeze.
   4. Spring hangers to support vertical runs.

N. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
   1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
   2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
   3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
   4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

O. Support vertical runs at each floor.

3.5 PIPE JOINT CONSTRUCTION

A. Braze joints according to Division 23 Section "Common Mechanical Materials and Methods."

B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.
3.6 FIELD QUALITY CONTROL

A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.

1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.

2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.

   a. System shall maintain test pressure at the manifold gage throughout duration of test.
   b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
   c. Fill system with nitrogen to raise a test pressure of 150 psig or higher as required by authorities having jurisdiction.
   d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of the conditioned air or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

   1. Open shutoff valves in condenser water circuit.
   2. Check compressor oil level above center of sight glass.
   3. Open compressor suction and discharge valves.
   4. Open refrigerant valves, except bypass valves that are used for other purposes.
   5. Check compressor-motor alignment, and lubricate motors and bearings.

3.8 CLEANING

A. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

3.9 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter-dryer after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION 23 23 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 07 for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
2. Division 08 for wall- and ceiling-mounted access doors for access to concealed ducts.
3. Division 08 for intake and relief louvers and vents connected to ducts and installed in exterior walls.
4. Division 23 Section "Duct Insulation for Mechanical Systems" for duct insulation.
5. Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment" for vibration isolation and seismic restraints of metal ducts.
6. Division 23 Section "Air Duct Accessories" for volume dampers, fire dampers, combination fire/smoke dampers, duct silencers, duct-mounted access doors and panels, turning vanes, screened openings, flexible connectors, and flexible ducts.
7. Division 23 Section "Air Terminal Units" for air terminals and additional installation requirements.
8. Division 23 Section "Diffusers, Registers, and Grilles."
9. Division 23 Section "Instrumentation and Control for HVAC" for automatic control dampers and operators.
10. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for air balancing and final adjusting of manual-volume dampers.

1.2 SUMMARY

A. This Section includes fabrication and installation of rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg.

1.3 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.
1.4 PERFORMANCE REQUIREMENTS

A. DUCT PRESSURE CLASSIFICATIONS

1. Rectangular Duct Static-Pressure Classifications: Construct ducts to the following:
   a. Supply Ducts, unless indicated otherwise: **2-inch wg**.
   b. Return Ducts: 2-inch wg, negative pressure.
   c. Exhaust Ducts: 2-inch wg, negative pressure.
   d. Outside Air Intake Ducts: 2-inch wg, negative pressure.

2. Round Duct Static Pressure Classifications: Construct ducts to the following:
   a. Supply Ducts, unless indicated otherwise: **2-inch wg**.
   b. Return Ducts: 2-inch wg, negative pressure.
   c. Exhaust Ducts: 2-inch wg, negative pressure.
   d. Outside Air Intake Ducts: 2-inch wg, negative pressure.

B. Pressure Classification:

1. Below 3-inch wg: Seal Class B; all transverse joints and longitudinal seams.

1.5 SUBMITTALS

A. General: See Section 23 05 00 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. Duct Liner and adhesives.
   2. Joint Sealants.
   3. Gaskets joint systems.

C. Shop Drawings: In addition to requirements set forth in Section 23 05 00, shop drawings for the listed systems shall also include duct sizes, top and/or bottom elevations, pressure classifications, combination fire/smoke dampers, fire dampers and smoke dampers, building structural components, connections to equipment, seam and joint construction, location of duct accessories, including dampers, turning vanes and access doors, and required service clearances. Provide submittals of the following metal duct systems:

   1. Supply Air
   2. Return Air
   3. Exhaust Air
   4. Duct Fittings

D. Coordination Drawings:
1. Comply with requirements in Section 01 33 00 and Section 23 05 00 for providing coordination drawings for areas as indicated on the drawings. Approved duct-work shop drawings shall be used to generate coordination drawings.

E. Reports and Certificates: Provide submittals of the following:

2. Duct Cleanliness Tests.
3. Welding certificates.

1.6 QUALITY ASSURANCE

A. Fabricate ducts and fittings according to SMACNA "HVAC Duct Construction Standards--Metal and Flexible" unless otherwise indicated.


C. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems" unless otherwise indicated.


1.7 DELIVERY, STORAGE, AND HANDLING

A. Keep metal ducts and duct liner dry and dust free during fabrication and storage at factory.

B. Before shipment shrink-wrap all openings of ducts fabricated with duct liner. During shipment, protect all metal ducts from weather.

C. Store all metal ducts in dry location on-site on elevated dunnage. Protect metal ducts from moisture, dirt, and dust.

D. Retain shrink-wrap protection of openings (where required to be protected) until immediately prior to connection of that opening to erected duct system.

E. On the event that any duct liner does get wet, dry duct liner within 48-hours using forced air heater. Ducts detected with moist fiberglass liner will be required to be replaced at no additional cost to the Owner.
F. Remove dust from the inside of metal duct sections as they are erected. Cover all openings with 6-mil poly and duct tape at the end of each workday to prevent dust migration into ducts.

G. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A 1008/A 1008M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.

C. Stainless Steel: ASTM A 480/A 480M, Type 304 or 316L, sheet form with polished finish for surfaces of ducts exposed to view; Type 304, sheet form with No. 1 finish for concealed ducts.

D. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form with standard, one-side bright finish for ducts exposed to view and with mill finish for concealed ducts.

E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DUCT LINER

A. Fibrous Glass Duct Liner: Comply with NFPA 90A and NAIMA AH124 "Fibrous Glass Duct Liner Standard." Can operated in temperatures up to 250-Degrees F and air velocities up to 5,000 fpm. ASTM C 1071 with coated surface exposed to airstream to prevent erosion of glass fibers. Coating contains EPA registered anti-microbial agent so it will not support the growth of fungus or bacteria, and is water repellent. Antimicrobial compound shall be tested for efficacy by the EPA for use in HVAC systems.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed Corporation; Insulation Group.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.
2. Thickness: See Duct Schedule.
3. Density: Minimum 2 lb per cubic foot.
4. Maximum Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
5. Fire-Hazard Classification: Maximum flame-spread rating of 25 and smoke-developed rating of 50, when tested according to ASTM E 84 and UL 723.
6. Minimum Noise Reduction Criteria (NRC): 0.55 for 1/2-inch, 0.70 for 1-inch, 0.90 for 1-1/2-inch and 1.0 for 2-inch tested per ASTM C 423 using Type A mounting.
7. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
   a. Tensile Strength: Indefinitely sustain a 50-lb-tensile, dead-load test perpendicular to duct wall.
   b. Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
   c. Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.
8. Johns Manville Spiracoustic Plus Round Duct Lining System. See Duct Schedule for thickness; preformed liner for ducts 8-inch through 18-inch diameter, round duct liner board for ducts greater than 18-inch diameter.

B. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bonded Logic, Inc.
   b. Reflectix Inc.
2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested according to ASTM C 518.
3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

2.3 SEALANT AND ADHESIVE MATERIALS
A. Joint and Seam Sealants:
1. Joint and Seam Sealant: Water-based vinyl or acrylic copolymer mastic formulated to withstand temperatures from minus 20 to plus 180 Degrees F, minimum of 65 percent solids, water resistant, VOC: maximum 75g/L (less water).
B. Duct Liner Adhesive: Water-based vinyl copolymer adhesive formulated to withstand temperatures from minus 20 to plus 160 Degrees F. Comply with NFPA 90A and ASTM C 916

2.4 HANGERS, SUPPORTS AND RESTRAINTS

A. Comply with Division 23, Section “Vibration and Seismic Controls for Mechanical Piping and Equipment.”

B. Building Attachments: Concrete inserts, stud-wedge or female wedge, mechanical-anchor bolts, or structural-steel fasteners appropriate for building materials. Powder actuated concrete fasteners are not allowed.

1. If concrete inserts cannot be used, install mechanical-anchor (stud-wedge or female wedge type) bolts in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer’s written instructions. Concrete inserts and mechanical-anchor fasteners shall be made of steel. Stainless steel for outdoor applications.

C. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
2. Straps and Rod Sizes: Comply with SMACNA "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.5 RECTANGULAR DUCT AND FITTING FABRICATION

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA "HVAC Duct Construction Standards--Metal and Flexible," based on indicated static pressure class, unless indicated otherwise. Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

3. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

   a. Prefabricated transverse joints shall comply SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," for static-pressure class, leakage rating.

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

         a) Duct Mate Industries, Inc.
         b) Ward Flange.

4. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

5. Material Thickness: For SMACNA "HVAC Duct Construction Standard – Metal and Flexible," but not less than 26 gauge.

B. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.

C. Elbow Configuration:

   1. Rectangular Duct: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "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 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

D. Branch Configuration:

   1. Rectangular Duct: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Conical or Bellmouth.
2.6 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is not allowed.

B. Apply adhesive to liner facing in direction of airflow not receiving metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liners in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12-inches transversely around perimeter; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

G. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profile or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharge.
2. Intervals of lined duct preceding unlined duct.

H. Additional liner requirements for duct velocities over 2500 fpm (12.7 m/s)

1. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
2. Upstream edges of transverse joints in ducts with metal nosings that have either channel or "Z" profile or are integrally formed from duct wall.
3. Secure insulation liner with perforated sheet metal liner of same metal thickness as specified for duct, secured to ducts with mechanical fasteners that maintain metal liner distance from duct without compressing insulation.
4. Sheet Metal Liner Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

I. Terminate liner with duct buildouts installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire-damper sleeve.
2.7 ROUND AND FLAT-OVAL DUCT FABRICATION

A. General: Diameter as applied to flat-oval ducts in this Article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat-oval duct. Minimum 26-gauge duct wall thickness.

B. Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA "HVAC Duct Construction Standards—Metal and Flexible," unless indicated otherwise.

C. Elbow Configuration:
   1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
      a. Round Elbows, 8 Inches and Smaller: Fabricate stamped elbows for 45- and 90-degree elbows and pleated elbows for 30-, and 60-degree elbows. Stamped elbows shall be 20 gauge thick minimum with two-piece welded construction. Fabricate nonstandard bend-angle configuration or non-standard diameter elbows with mitered construction.
      b. Round Elbows, 9 through 12 Inches: Fabricate segmented (mitered) or pleated elbows for 30, 45, 60, and 90 degrees. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with mitered construction.
      c. Round Elbows, Larger than 12-Inches: Segmented (mitered) elbows for all bend angle configurations.
      d. Round Elbows, Segmented (mitered) Two-Piece 90-Degree: Use only where specifically indicated. Fabricate with single turning vane.

D. Branch Configuration:
   1. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are not permitted.
      a. 90-degree Tee Fittings:
         1) Main to Branch (branch greater than 2/3 the diameter of main or 12-inch diameter branch): Use 90 degree conical tee fitting. 90-degree conical taps or 90-degree lateral fittings can be used for all others.
         2) 45 degree lateral tee and 45-degree elbow in lieu of 90-degree tee fitting or tap on supply ductwork where space allows.
      b. 45-degree Tee Fittings:
         1) Main to Branch (branch greater than 2/3 the diameter of main or 12-inch diameter branch): Use 45-degree lateral fitting. 45-degree lateral taps or 45-degree lateral can be used for all others.
2.8 ROUND AND FLAT-OVAL SUPPLY AND EXHAUST FITTING FABRICATION

A. 90-Degree Tee Fittings and Taps: Fabricate to comply with SMACNA "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.

B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

C. Round Elbow Construction: Fabricate in die-stamped, pleated, or mitered construction as indicated above. Fabricate bend radius of elbows to one and one-half times elbow diameter. Unless elbow construction type is indicated otherwise, fabricate elbows as follows:

1. Mitered Elbow Pieces: Welded construction with 5-pieces for 90-degree elbow, 4-pieces for 60-degree elbow and 3-pieces for 45-degree elbow.
2. Metal Thickness, Pressure Classes from Minus 2- to Plus 2-inch wg:
   a. Ducts 3 to 26 Inches in Diameter: 24-gauge.
3. Metal Thickness, Pressure Classes from Minus 2- to 10-inch wg:
   a. Ducts 3 to 14 Inches in Diameter: 24-gauge.

D. Elbow Configuration:

1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
   a. Round Elbows, 8 Inches and Smaller: Fabricate stamped die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30-, and 60-degree elbows. Stamped Die formed elbows shall be 20 gauge thick minimum with two-piece welded construction. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with mitered construction.
   b. Round Elbows, 9 through 12 Inches: Fabricate segmented (mitered) or pleated elbows for 30, 45, 60, and 90 degrees. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with mitered construction.
   c. Round Elbows, Larger than 12-Inches: Segmented (mitered) elbows for all bend angle configurations.
   d. Round Elbows, Segmented (mitered) Two-Piece 90-Degree: Use only where specifically indicated. Fabricate with single turning vane.
   e. Flat Oval Elbows: Segmented (mitered) type.

E. Branch Configuration:

1. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are not permitted.
a. 90-degree Tee Fittings:
   1) Main to Branch (branch greater than 2/3 the diameter of main or 12-inch diameter branch): Use 90 degree conical tee fitting. 90-degree conical taps or 90-degree lateral fittings can be used for all others.
   2) 45 degree lateral tee and 45-degree elbow in lieu of 90-degree tee fitting or tap on supply ductwork where space allows.

b. 45-degree Tee Fittings:
   1) Main to Branch (branch greater than 2/3 the diameter of main or 12-inch diameter branch): Use 45-degree lateral fitting. 45-degree lateral taps or 45-degree lateral can be used for all others.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.

B. Provide access panels every 50 feet on all medium pressure ductwork for inspection and duct clearing.

C. Construct and install each duct system for the specific duct pressure classification indicated.

D. Install round and flat-oval ducts in lengths not less than 12 feet, unless interrupted by fittings.

E. Install ducts with fewest possible joints.

F. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

G. Install couplings tight to duct wall surface with a minimum of projections into duct.

H. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

K. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
L. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work. Allow for post-construction access to air terminals, volume dampers, and other components requiring maintenance and/or readjustment.

M. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures, unless ductwork is intended to serve these spaces.

N. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.

O. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated combination fire/smoke damper or fire damper sleeve, and firestopping sealant. Fire, smoke and combination fire/smoke dampers are specified in Division 23 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 07 Section "Firestopping."

3.2 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints according to the duct seal class described in SMACNA "HVAC Duct Construction Standards--Metal and Flexible" corresponding to the pressure class given below.

B. Pressure Classification:

1. 3-inch wg and Greater: Seal Class A; all transverse joints, longitudinal seams and duct wall penetrations.
2. Below 3-inch wg: Seal Class B; all transverse joints and longitudinal seams.

C. Seal externally insulated ducts before insulation installation.

3.3 HANGING, RESTRAINING, AND SUPPORTING

A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards--Metal and Flexible."

B. Install duct seismic restraints as indicated in Division 23, Section “Vibration and Seismic Controls for Mechanical Piping and Equipment.”

C. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Support vertical ducts at a maximum interval of 16 feet and at each floor.

E. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
F. Install concrete inserts before placing concrete.

G. Install mechanical-anchor fasteners after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

3.4 CONNECTIONS

A. Unless indicated otherwise, connect metal ducts to rotating equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA "HVAC Duct Construction Standards--Metal and Flexible," unless indicated otherwise.

3.5 FIELD QUALITY CONTROL

A. Leakage Test:

1. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.

2. Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing. Test ducts in shafts prior to shaft enclosure.

3. Determine leakage from entire system or section of system by relating leakage to surface area of test section.

4. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.

5. Remake leaking joints and retest until leakage is less than maximum allowable.


B. 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 according to "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.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.
E. Leakage Test: Perform tests according to SMACNA "HVAC Air Duct Leakage Test Manual." Submit test report for the following:

1. Ductwork constructed with a duct static pressure classification greater than 3-inch w.g.

3.6 ADJUSTING

A. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for detailed procedures.

3.7 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Fan-coil unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.


5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.


7. Dedicated exhaust and ventilation components and makeup air systems.
E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

B. Intermediate Reinforcement:


END OF SECTION 23 31 13
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 08 Section "Access Doors and Frames" for wall- and ceiling-mounted access doors and panels.
2. Division 08 Section "Louvers and Vents" for intake and relief louvers and vents connected to ducts and installed in exterior walls.
3. Division 23 Section "Metal Ducts" for ductwork, duct liner and duct sealants.
4. Division 23 Section "Diffusers, Registers, and Grilles."

1.2 SUMMARY

A. This Section includes the following:

2. Motorized dampers.
3. Actuators.
4. Flexible connectors.
5. Screened openings.
6. Duct accessory hardware.

1.3 SUBMITTALS

A. Product Data: For the following:

2. Motorized dampers with actuator.
3. Flexible connectors.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.
C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Manual Volume Dampers:
   a. Ruskin.
   b. American Warming & Ventilating.
   c. Greenheck.

2. Motorized Dampers:
   a. Ruskin.
   b. American Warming & Ventilating.
   c. Greenheck.

3. Actuators:
   a. Belimo

4. Flexible Connectors:
   a. Ductmate
   b. Durodyne
2.2 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL-VOLUME DAMPERS

A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

B. Steel Low-Leakage Volume Dampers: Multiple- or single-blade, opposed-blade design unless indicated otherwise, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 16 gauge thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.

2. Roll-Formed Steel Blades: 16 gauge thick, galvanized, sheet steel.


5. Tie Bars and Brackets: Galvanized steel.

2.4 MOTORIZED DAMPERS

A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
B. Steel Low-Leakage Volume Dampers: Multiple- or single-blade, opposed-blade design unless indicated otherwise, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 16 gauge thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 16 gauge thick, galvanized, sheet steel.
5. Tie Bars and Brackets: Galvanized steel.

C. Actuator shall be Manufactured by Belimo and shipped with motorized damper.

2.5 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1. Fabricate designed to meet UL 214, NFPA 90A, airtight and waterproof.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-inches wide attached to two strips of 3-inch-wide, minimum 24-gauge thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

C. Extra-Wide Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches wide attached to two strips of 3-inch-wide, minimum 24-gauge thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

D. Transverse Flanged Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 4-3/8-inch-wide, 24-gauge thick, galvanized, sheet steel or 0.032-inch aluminum sheets formed for flanged type connection. Select metal compatible with connected ducts.

   1. Minimum Weight: 22 oz./sq. yd..
   2. Tensile Strength: 240 lbf/inch in the warp, and 220 lbf/inch in the filling.

F. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
   1. Minimum Weight: 24 oz./sq. yd..
   2. Tensile Strength: 500 lbf/inch in the warp, and 500 lbf/inch in the filling.
2.6 SCREENED OPENINGS

A. Screened Openings: 16-gauge steel angle frame enclosing 1/2-inch mesh, 14-gauge galvanized steel wire screen.

2.7 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 length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

E. Concealed Damper Regulators: Gear operated linkage, minimum 3/8-inch diameter, steel rod, chrome plated ceiling cover, flush mount.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Volume Dampers:

1. Install volume dampers at all diffuser and grille duct connections. Place as far upstream as layout and accessibility allow.
2. Install manual volume dampers in duct.

C. Motorized Dampers:

1. Install motorized dampers at the exterior relief or inlet louver.
2. Provide access to actuator from inside building.

D. Damper Actuators: Actuators shall not be mounted in the air stream.

E. Provide instrument test holes where indicated.
3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 23 33 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Division 08 for fixed and adjustable louvers and wall vents, whether, or not they are connected to ducts.
   2. Division 23 Section "Duct Accessories" for volume-control dampers not integral to diffusers and grilles.
   3. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for balancing diffusers and grilles.

1.2 SUMMARY

A. This Section includes ceiling and wall-mounted diffusers and grilles.

1.3 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, or ceiling.

1.4 SUBMITTALS

A. Product Data: For each model indicated, include the following:
   1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
   2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
   3. Schedule of diffusers and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
1.5 QUALITY ASSURANCE


PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 MANUFACTURED UNITS

A. Diffusers and grilles are scheduled on Drawings.

2.3 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

2.4 CEILING DIFFUSERS

A. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

B. Ceiling Compatibility: Provide diffusers with border styles that are compatible with ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.

C. Types: Provide ceiling diffusers of type, construction, capacity, and with accessories and finishes as indicated.

1. Ceiling Diffuser – Round Adjustable Louver (RAL)
   a. Model #: TMR
   b. Material: Steel, 18 gauge
   c. Diffuser Construction: Round neck; four concentric round cones, three inner cones removable. Cones each one piece die stamped construction.
The inner cone assembly is adjusted by rotating the center cone to change airflow discharge from horizontal to vertical.

d. Finish: White, anodic acrylic paint or aluminum colored paint.

e. Accessories:
   1) Opposed blade damper, operable from the face of the diffuser (OBD).

2.5 SUPPLY GRILLES

A. Performance: Provide supply grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

B. Wall Compatibility: Provide grilles with border styles that are compatible with wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction, which will contain each type of wall grille.

C. Types: Provide supply grilles of type, construction, capacity, and with accessories and finishes as indicated.

1. Supply Grille – Louvered

   a. Model#: 300RLHD

   b. Materials: 20 gauge steel frame with heavy duty aluminum blades

   c. Grille Construction: 1-1/4-inch wide border, corners assembled with full penetration resistance welds. Screw holes countersunk. Double deflection solid airfoil blades, front blades parallel to the long dimension, spaced on 3/4-inch centers. Blades shall extend through the side frame on each side. Blades shall be individually adjustable, held in place with tension wire, adjustable without loosening or rattling.

   d. Finish: White, anodic acrylic paint.

   e. Accessories: Opposed blade damper, operable from the face of the grille (OBD).

2.6 EXHAUST/RETURN GRILLES

A. Performance: Provide exhaust and return grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

B. Ceiling Compatibility: Provide grilles with border styles that are compatible with ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of grille.
C. Wall Compatibility: Provide grilles with border styles that are compatible with wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction, which will contain each type of wall grille.

D. Types: Provide exhaust and return grilles of type, construction, capacity, and with accessories and finishes as indicated.

1. Exhaust/Return Grille – Louvered
   a. Materials: 22-gauge roll formed steel frame and blades or 0.040 minimum extruded aluminum frame and blades.
   c. Finish: White, anodic acrylic paint or aluminum colored paint.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers and grilles level and plumb, according to manufacturer's written instructions, project Coordination Drawings, original design, and referenced standards.

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 practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Duct-Mounted Supply and Exhaust/Return Grilles: Mount to duct branch with 16-gauge steel angle collar. Mounting screws to match grille frame. Screws shall not protrude more than 1/4-inch past angle collar.

Install diffusers and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
3.3 ADJUSTING

A. After installation, adjust diffusers and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers and grilles that have damaged finishes.

END OF SECTION 23 37 13
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Division 23 Section "Instrumentation and Control for HVAC" for control wiring and control devices connected to energy recovery units.

1.2 SUMMARY

A. This Section includes the following:
   1. Packaged energy recovery units.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.
   1. Include plans, elevations, sections, details, and attachments to other Work. For installed products indicated to comply with design loads, include structural analysis data.
   2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain air-to-air energy recovery units through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of air-to-air energy recovery units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

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. ASHRAE Compliance: Capacity ratings for energy recovery devices shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."

E. NRCA Compliance: Roof curbs for roof-mounted equipment shall be constructed according to recommendations of NRCA.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Furnish one set of each type of filter specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
2.2 PACKAGED ENERGY RECOVERY UNITS

A. Manufacturer:
   1. Renewaire.

B. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, gasketed and calked weathertight, hinged access doors with neoprene gaskets for inspection and access to internal parts, minimum 1-inch thick thermal insulation, knockouts for electrical and piping connections, exterior drain connection, and lifting lugs.
   1. Inlet: Weatherproof louver, with motorized dampers for exhaust and outside air intake.

C. Heat Recovery Device: Static plate heat exchanger.

D. Supply and Exhaust Fans: Forward-curved centrifugal fan and flexible duct connections.
   1. Motor and Drive: Direct driven
   2. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

E. Filters: 1-inch thick thick MERV 8 disposable type, in galvanized steel frame, mounted upstream of unit in both supply and exhaust airstreams.

F. Piping and Wiring: Fabricate units with space within housing for piping and electrical conduits. Wire motors and controls so only external connections are required during installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install heat wheels so supply and exhaust airstreams flow in opposite directions and rotation is from exhaust side to purge section to supply side.
   1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
   2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
   3. Access doors and panels are specified in Division 23 Section "Air Duct Accessories."

B. Install heat-pipe heat exchangers so supply and exhaust airstreams flow in opposite directions. Install flexible connectors on ducts to enable tilt control; make connections airtight and with slack to compensate for full tilt.
1. Install heat exchanger with clearance space for heat-pipe coil removal.
2. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to both sides of heat-pipe coil. Access doors and panels are specified in Division 23 Section "Air Duct Accessories."
3. Install tilt-control components, including electronic controller, electric actuator and linkage, thermostats, and sensors.

C. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.

1. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to heat exchanger. Access doors and panels are specified in Division 23 Section "Air Duct Accessories."

D. Support suspended units from structure; use threaded steel rods.

E. Install units with clearances for service and maintenance.

F. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

G. Pipe drains from units and drain pans to nearest floor drain; use ASTM B 88, Type L, drawn-temper copper water tubing with soldered joints, same size as condensate drain connection.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Duct and fan installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and specialties.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Adjust seals and purge.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Set initial temperature and humidity set points.
5. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 72 00
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. Division 23 Section 23 05 00 “Common Work Results for HVAC.”
2. Division 23 Section “Common Motor Requirements for Mechanical Equipment.”
3. Division 23 Section “Vibration and Seismic Controls for Mechanical Piping and Equipment.”
4. Division 23 Section “Identification for Mechanical Piping and Equipment.”
5. Division 23 Section “Instrumentation and Controls for HVAC.”
6. Division 23 Section “Refrigerant Piping.”

1.2 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may, or may not be connected to ducts.

1.3 SUBMITTALS

A. General: See Section 23 05 00 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. Evaporator sections
2. Condensing units
3. Refrigerant piping

C. Shop Drawings: In addition to requirements set forth in Section 23 05 00, shop drawings for the listed systems shall also include: None required.

D. Reports and Certificates: Provide submittals of the following:

1. Mechanical Seismic Qualification Certificates: For evaporators, and condensing units from manufacturer as required in 23 05 48 “Vibration and Seismic Controls for Mechanical Piping and Equipment.”
2. Start-up and reports. See “Field Quality Control” article.
1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.


C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Units shall be designed to operate with HCFC-free refrigerants.

1.5 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 07 Section "Roof Accessories."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

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

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Mitsubishi Heavy Industries America, Inc.; Air-Conditioning & Refrigeration Division, Inc.
2. Daikin

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.

D. Fan: Direct drive, centrifugal fan.

E. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for Mechanical Equipment."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

F. Filters: Permanent, cleanable.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Scroll.
2. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
3. Refrigerant Charge: R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.
F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).

H. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
   1. Compressor time delay.
   2. 24-hour time control of system stop and start.
   3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
   4. Fan-speed selection, including auto setting.
   5. 7-day programmable

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounting, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install ground-mounting, compressor-condenser components on polyethylene mounting base.
E. Install seismic restraints.

F. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch (25 mm). Refer to Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment."

G. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 81 26
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related sections include the following:
   1. Division 23 Section "Common Motor Requirements for HVAC Equipment" for fan motor requirements.
   2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for spring hangers and seismic restraints.

1.2 SUMMARY

A. This Section includes electric unit heaters.

1.3 SUBMITTALS

A. General: See Section 23 05 00 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. Electric Unit Heaters.

C. Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed wiring and field-installed wiring.

D. Reports and Certificates: Provide submittals of the following:
   1. Field test reports from a qualified independent inspecting and testing agency indicating and interpreting test results relative to compliance with performance requirements of unit heaters.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty on Heat Exchangers: Submit a written warranty signed by manufacturer agreeing to replace components within specified warranty period indicated below. Warranty covers failure due to normal conditions of use.

1. Special Warranty Period: Manufacturer's standard but not less than 5 years after date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide unit heaters and cabinet heaters by one of the following:

1. Electric Unit Heaters:
   a. King
   b. Modine.

2.2 ELECTRIC UNIT HEATERS

A. Heating Elements: Nickel-chromium heating wire element; free from expansion noise and 60-Hz hum; embedded in magnesium oxide, insulating refractory; and sealed in high-mass steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends are enclosed in terminal box. Fin surface temperature does not exceed 550 deg F at any point during normal operation.

B. Heater Circuit Protection: One-time fuses in terminal box for overcurrent protection and automatic reset thermal overloads for overtemperature protection of heaters. Manual reset required in the event of thermal overload trip.

C. Fan and Motor: Whisper quiet tangential blower driven from shaded-pole, permanently lubricated, C-frame motor with impedance protection and sealed bearings. Motors sized 1 hp and less include motor overload protection.
D. Wiring: Heaters designed for a single circuit, with elements, motor and control circuits subdivided with factory wired fuses to conform to the National Electric Code and Underwriter's Laboratory, Inc., Standard 1025.

E. Unit Control: Contactors and control circuit transformers where required are factory installed and wired. Only direct line supply and thermostat connections in the field are required. Built-in fan override is provided to purge unit casing of excess heat after unit shutdown. Provide 7-day programmable wall-thermostat. Provide control range 45°F to 90°F.

F. Discharge Configuration: Discharge with horizontal, adjustable louvers, vertical discharge with radial louver diffuser as indicated.

G. Optional Accessories: Include the following:

1. Integral power disconnect switch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters and cabinet heaters for compliance with requirements for installation tolerances and other conditions affecting performance of units. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install unit heaters and cabinet heaters as indicated, according to manufacturer's written instructions and NFPA 90A.

B. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level. Install cable type seismic restraints.

   1. Spring hangers and seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install controls as specified in Division 23 Section "Instrumentation and Control for HVAC."

3.3 CONNECTIONS

1.

B. Electrical: Conform to applicable requirements of Division 26 Sections.
1. Install electrical devices furnished with heaters but not specified to be factory mounted.

C. Connect heaters and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 ADJUSTING AND CLEANING

A. Adjust burner and other unit components for optimum heating performance and efficiency. Adjust heat distribution features, including louver, vanes, shutters, dampers, and reflectors, to provide optimum heat distribution for objects, personnel, and spaces served.

B. After completing system installation, inspect heaters and associated components. Repair scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

C. Replace filters in each cabinet heater at completion of construction.

3.5 START-UP PROCEDURES

A. Start-up Services: Provide start-up service, as specified below.

1. Start units and operate controls and safeties.
2. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
3. Correct deficiencies identified by tests and observations and retest until specified requirements are met.

END OF SECTION 23 82 39
PART 1 - GENERAL

1.01. APPLICABLE PROVISIONS

A. The General, Supplementary and other Conditions of the Contract, modifications to the General Conditions, the Drawings, and the applicable provisions of the other Divisions are hereby made a part of this Division and all its sections.

1.02. SUMMARY

A. The requirements of this Section and the other Division 26, 27 & 28 sections apply to all the electrical work.

B. Coordinate electrical work with related work shown and specified elsewhere.

C. Work Included: The Contractor shall perform all the Work required (including the furnishing of all supervision, labor, services, tools, materials and equipment and the performance of all operations and incidentals necessary) for a complete, safe and reliable electrical installation, adjusted, tested and ready for operation. The electrical work is generally described as follows:

1. Coordination and scheduling.

2. Power distribution system including meter base, switchboard, feeders, panelboards, transformers, circuit breakers, disconnect switches, fuses, etc.


5. Wiring devices and special purpose receptacles, including generator receptacle.

6. Ancillary systems raceways, cable trays, boxes, etc.

7. Lighting fixtures, poles and bases.

8. Lighting controls and devices.

9. Branch circuit wiring system for lighting, outlets, equipment, etc.

10. Disconnecting means, switches, receptacles, motor starters, control devices, etc. (installation only if furnished with the equipment), and final power and line voltage (120 volt or greater) control connections to equipment and devices provided by the Owner, General Contractor or other Sub-Contractors, including the following:

   a. HVAC equipment and associated variable frequency drives, line voltage control devices, etc.;
b. Plumbing systems equipment and associated variable frequency drives, line voltage control devices, etc.;

11. Starters, contactors, relays, etc. and associated panels.

12. Line voltage (120 volt or higher) control stations, devices, conduit, boxes, wiring, etc. (installation only if furnished with mechanical equipment).

13. Telecommunications (e.g. voice, data/computer network, cable television) wire management racks, patch panels, terminal blocks, outlets, conduit, wiring, etc.


15. Supports.


17. Pull strings and ropes.

18. Trenching and backfilling for underground electrical work.

19. Cutting and patching, core drilling, etc.

20. Moisture, fire and dust stopping and sealing.

21. Temporary construction power & lighting.


23. Commissioning of electrical systems.

24. Final cleaning.

25. Obtaining and paying for all required licenses, permits, inspections and fees.

D. Work not included: The following electrical system related work will be provided by the Owner, General Contractor, other Subcontractors, or Systems Contractors working directly with the Owner:

1. Mechanical Contractor: Mechanical equipment and systems low voltage control wiring, conduits, devices, etc. See mechanical specification sections and schedule on drawings.

2. Mechanical Contractor: Mechanical equipment and systems line voltage control devices, etc (except, installation by Contractor). See mechanical specification sections and schedule on drawings.
1.03. EXISTING CONDITIONS

A. Before submitting bid, examine existing site (and building or equipment) conditions to determine effect on execution of the electrical work and include costs in bid.

B. Existing circuits indicated on the plan are based on what was shown on the original building construction drawings and may not be exactly how the actual construction was done. The contractor shall expect that an extensive amount of circuit tracing to determine how the actual circuits are installed will be required.

C. Underground utilities (electrical, water, sewer, cable television, etc.) are known to exist in the area of construction. The location of existing utilities shown on the drawings is approximate only and is not guaranteed to be an indication of all utilities in the area. The contractor is responsible for contacting the Owner and all utility companies and for field location of all utilities prior to construction. The one-call number for underground utility location services is 1-800-424-5555. The Contractor shall promptly notify the Engineer of any conflicts between the contract documents and field location of existing utilities. The Contractor is responsible for maintaining the integrity of all existing utilities during construction.

D. Damaged electrical and telecommunications (telephone, computer/data, television, fiber, copper, etc.) cables shall be replaced in their entirety. Splicing will not be allowed.

1.04. PLAN REVIEW AND PERMITS

A. The Contractor shall arrange for inspections and pay for all required licenses, permits, inspections and fees.

B. The spaces served by the existing electrical system do not include any educational occupancies. It is not anticipated that submittal to WA Department of L&I for electrical plan review will be required.

1.05. DEFINITIONS

A. The term "Contractor" used throughout Division 26, 27 and 28 of these specifications and on the electrical drawings shall be understood to mean the Electrical Contractor. All other work shall be called out by name.

B. “Approved” means approved by the Architect. “For approval” means for the Architect’s approval.

C. “Furnish” means to supply and deliver to the Project, ready for installation and in operable condition.

D. “Install” means to incorporate in the work in final position, complete, anchored, connected, and in operable condition.

E. “Provide” means furnish and install.
F. "Remove" means to remove the existing item indicated and all associated conduit, boxes, cables, etc. to their point of origin and/or destination; except, concealed conduits and flush boxes may be abandoned in place and/or re-used in the new installation. Cables shall be removed and/or replaced.

G. "Replace" means to remove the existing and add in lieu the new as indicated.

H. “As directed” means as directed by the Architect.

I. “Concealed” means hidden from sight in trenches, walls, chases, ceilings, etc.

J. “Exposed” means within sight; that is, not concealed as defined above, and installed on the surface of walls, ceilings, etc.

K. “C.O.” means conduit only; that is, without cable (except, provide pull string or rope).

L. “F.O.I.C.” means Furnished by Others (e.g. general contractor, other subcontractors, equipment suppliers, Owner, systems contractors working directly with the Owner, etc.), Installed by Contractor.


N. See telecommunications section 27 05 00 for additional definitions.

O. Definitions of all other terms, etc. are in accordance with AIA, ANSI, IEEE, IES, NEMA, etc. standard definitions.

1.06. DRAWINGS & SPECIFICATIONS

A. The electrical plan drawings are general in form and do not attempt to show complete details or list every item of the electrical systems, the building construction or the various equipment (new or existing); however, the routing of raceways and circuits, and the locations of equipment, devices, fixtures, etc. Represent the desired finished arrangement; except, as governed by structural or mechanical conditions or obstructions.

B. Existing circuits indicated on the plan are based on what was shown on the original building construction drawings and may not be exactly how the actual construction was done. The contractor shall expect that an extensive amount of circuit tracing to determine how the actual circuits are installed will be required.

C. Specifications are, in some cases, written in an abbreviated form. Words such as shall, shall be, the Contractor shall, and similar mandatory phrases are supplied by inference.

D. Investigate the structural and finish conditions affecting the work. Refer to the architectural, structural and mechanical drawings, supplier shop drawings and submittals, etc. for additional details, equipment ratings, dimensions, location and swing of doors, location and size of partitions, cabinets, etc. and similar features. Verify all dimensions, equipment ratings, etc. with the actual before installation. Arrange the work accordingly.
E. The intent of the drawings and specifications is to include all items necessary for the proper execution and completion of the Work; however, any item or detail not specifically mentioned in the specifications or shown on the drawings, but which is necessary to produce the intended results shall be included.

F. The Contractor shall bring to the Engineer's attention any discrepancies, inconsistencies, conflicts, errors, or omissions within the Contract Documents, between the Contract Documents and field conditions, and any design and layout changes required due to specific equipment selection, etc. prior to equipment and material purchasing and installation. If Contractor purchases any equipment or materials and performs any construction activity, and it knows or reasonably should have known that the documents contain a discrepancy, inconsistency, conflict, error or omissions, corrective work shall be at the Contractor's expense.

G. In the event that there are discrepancies between requirements shown on different sheets of the drawings or between the drawings and the specifications, the more restrictive of the requirements shall apply.

H. Verify all equipment and device locations with the Owner and Architect prior to rough-in.

I. Verify exposed raceway routing with the Owner, Architect and Engineer prior to rough-in.

1.07. SUBMITTALS

A. Refer to Division 01, Section 01 33 00 Submittal Procedures.

B. Submittals from the electrical contractor and each sub-contractor shall include a cover page indicating the company name, project manager name, and contact information for the contractor.

C. Forward all submittals to the Architect, together in a complete package, at one time, in electronic format as single .pdf files for each specification section. Submittals for individual products or incomplete submittals are not acceptable and will be returned without review.

D. Submittals shall be grouped by specification section and shall be arranged in the same order in which they are found in the specifications to facilitate the review process.

E. Re-submittals, when requested, shall be provided as complete and comprehensive for each specification section. Re-submittals for individual products or incomplete re-submittals are not acceptable and will be returned without review.

F. Provide submittals for the equipment, boxes, devices, fixtures, special raceways, systems and their components, etc. as directed in the various sections of the specifications.

G. Prepare detail layout drawings to a larger scale than the contract drawings in areas where the work is of sufficient complexity to warrant additional detailing.

H. Submittal drawings shall be on standard size sheets no larger than the contract drawings.
I. Submit M.S.D.S. (Manufacturer's Safety Data Sheets) for all chemicals or hazardous materials. All chemicals and hazardous materials to meet NIOSH Permissible Exposure Levels (P.E.L.) and OSHA Time Weighted Average (T.W.A.) requirements before commencing work.

J. If requested by the Owner, provide samples of materials for evaluation.

K. Submittals shall provide sufficient detail so compliance with the drawings and specifications can be ascertained. Clearly identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and review materials and equipment.

L. Catalog pages containing more than one product shall be marked with arrows to indicate the proposed product.

M. Obtain approval before purchasing any products. Items not in accordance with the drawings and specifications will be rejected.

N. The Contractor shall establish quantities, check drawings and data, verify space requirements, dimensions, and possible interferences prior to submittal. Submittals which indicate quantities will not be reviewed by the Engineer for accuracy of quantity.

O. The Architect and Engineer will review each submittal, mark to indicate action taken, and return. Compliance with specified characteristics is the Contractor's responsibility.

P. Approval of submittals does not release the Contractor from a proper installation, compliance with the drawings, specifications, codes, standards, etc. or coordination of the work.

Q. Allow two weeks turnaround time for each submittal from the time of receipt at the engineer's office, except the engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until the related submittals are received.

1.08. SUBSTITUTE PRODUCTS APPROVAL

A. Refer to Division 01, Section 01 61 00 Common Product Requirements.

B. During Bidding:

1. Substitutions for equipment and materials other than that specified will be considered if equal (or better and/or higher) in quality, ratings and function; and similar in type, style, size and appearance.

2. Submit written requests to Owner, Architect and Engineer.

   a. If received no later than 7 work days prior to Bid opening, requests will be considered, but not thereafter.

   b. Bidders will be informed by Addendum of any approved items.

   c. No responses will be provided for rejected items.
3. Requests shall be accompanied by complete specifications, samples, record or performance, certified tests by impartial, recognized laboratories, and other such information as required to clearly represent the proposed substitution.

4. Lighting fixture substitution requests shall include photometric data.

5. Final decisions as to quality and suitability of proposed substitutions rest solely with the Owner, Architect and Engineer, and will be based on proof submitted.

6. The cost of changes required in order to incorporate the proposed substitution, such as revisions to controls, raceways, wiring, openings, appurtenances, etc., shall be included in the bid. Any cost reduction resulting from substitutions shall benefit the Owner through a reduced bid.

7. When Owner, Architect and Engineer approve a proposed substitution, it is with the understanding that Bidder certifies that substitute articles or materials are equal to or better than those specified and that no exception is taken with any of the performance objectives, service or warranty requirements or features herein specified.

C. After Bidding:

1. Substitute products requests will not be considered.

2. Product substitutions are allowed solely under the conditions stated in Division 1 Section “Product Requirements.”

1.09. RECORD DOCUMENTS

A. Submit record documents at completion of the project in accordance with the specific submittal requirements listed elsewhere in these documents.

B. Provide “as-built” drawings in both full size reproducible form and in software form as AutoCAD .dwg type files.

C. All record documents in software form shall be transmitted in electronic format. Include the necessary program(s) to read test results. Separate submittals for the various disciplines will not be accepted.

1.10. "AS BUILT" DRAWINGS

A. The Contractor shall continuously maintain a marked job set of as-built drawings as the work progresses, to indicate deviations from the original design, including change orders. Maintain records of all concealed wiring and of actual equipment, device, etc. locations. Provide dimensions from accepted reference lines as needed. The as-built drawings shall be kept on-site and available for inspection by the Owner.
B. Include any detailed equipment, raceway, wiring, etc. diagrams and layouts prepared by Contractor or his subcontractors, suppliers, etc.

C. At substantial completion, Contractor shall modify one complete set of reproducible copies, with all "as built" information and submit these drawings to the Owner for approval. Each sheet shall be marked "CORRECTED TO AS BUILT"; or, if there are no changes, drawings shall be marked "NO CHANGES, INSTALLATION PER PLAN".

D. After approval, Contractor shall transfer all "as built" information from the marked job set and other information as appropriate to AutoCAD .dwg type files. (Consultant/Engineer will provide construction drawings AutoCAD files to contractor.) Utilize the layering scheme, font types, line types, title block, etc. provided in the AutoCAD drawing files. All drawings shall be noted as “As-Built” with a stamp and date. After adding the “as-built” information, return the AutoCAD files to the Consultant/Engineer for inclusion into the final project record set.

E. “As-built” drawings for all portions of the work shall be combined into a single set matching the contract documents. Separate submittals for the various disciplines will not be accepted.

1.11. OPERATION AND MAINTENANCE MANUALS

A. Refer to Division 01, Section 01 77 00 Closeout Procedures.

B. Following installation of the electrical systems, but prior to acceptance of the work, Contractor shall submit to Architect one preliminary O&M Manual in .pdf format, with information systematically segregated and tabbed for easy reference to be reviewed by the Owner, Architect and Engineer. This submittal copy will be returned to the Contractor, and the material can be used in preparation of final volumes. After approval of preliminary copy, but prior to project completion, submit 3 finished copies in paper loose-leaf format, with indexed and tabbed for easy reference.

C. Format shall be 8½" x 11" size with neat, clean copies, drawings (accordion folded), etc. Manuals shall have a typewritten index, and divider sheets with identification tabs between categories. Manuals shall be in hard cover 3 ring binders with titles permanently embossed on the cover face and the spine. The front of each volume shall be imprinted with the project name, title (e.g. "Electrical Equipment and Devices Operating Instructions and Maintenance Manual"), Owner, Architect, Electrical Engineer and Contractor.

D. O&M Manuals may be submitted electronically in pdf format, if approval is given by the architect. Manuals shall be compiled into a single .pdf file for the entire project, or a single .pdf file for each specification Division.

E. Manuals shall include:

   1. Record documents (see above); except, full size reproducible bond paper copy of drawings to be provided separately.

   2. Submittals, updated to "as built" conditions.
3. Test results; except, telecommunications equipment, cables, etc. test results shall be in a separate binder.

4. Description of systems configuration and operation including component identification and interrelations, including diagrams and supplementary drawings where necessary.

5. Installation, operation, maintenance and programming manuals covering the installed systems, equipment and materials.

6. Maintenance instructions (frequency of service, type of service, etc.).

7. Parts lists for all equipment; including recording information, recommended spares and anticipated useful life.

8. Supplier's names, addresses, telephone and reference order numbers for all equipment and materials.

9. Warranties and Bonds.

10. Copies of final inspection certificates from the authorities having jurisdiction.

F. Omit non-applicable data.

1.12. WARRANTY

A. The complete installation shall be guaranteed for a period of one (1) year after date of project completion. For warranty purposes, the date of project completion shall be considered the date of final acceptance of the installation by the Owner certified in writing, and after Owner has received all project close-out requirements. All corrective work, if needed and requested by the Owner, shall be provided without cost to the Owner during the guarantee period.

B. All corrective work performed by the Contractor in remedying defective work during the guarantee period following the Owner's acceptance of the project shall be subject to the same guarantee requirements of the original work for a period as specified from the date of completion of the corrective work.

C. Corrective work shall include on-site service by the Contractor, subcontractor or supplier (e.g. fire alarm and telecommunications systems), and/or nearest technical service representative of the equipment manufacturer. Service shall be provided within 24 hours from the time of request for warranty service by the Owner.

1.13. TRAINING/INSTRUCTION AND ASSISTANCE

A. After the installation is complete and operating, and prior to acceptance of the work, conduct a minimum of a one (1) hour training/instruction period at the site for each type of system to point out locations of service and maintenance and instruct the Owner's in the operation of all systems and equipment.
B. The person(s) who conduct these instructions and demonstrations shall be a qualified representative(s) of the manufacturer with substantial training and operating experience on this equipment and project, and shall be versed in the operating theory as well as practical operation and maintenance work. Instructor(s) shall have the necessary educational and interpersonal skills, as well as proven ability to effectively perform the training. Their qualifications shall be submitted to the Owner before conducting the instruction period.

C. Each period shall include preliminary discussion and presentation of information using the actual maintenance manuals required for this project. Contractor shall notify Owner and Engineer at least 48 hours in advance of readiness to conduct the instruction period. The actual time and date of instruction period shall be acceptable to the Owner and Engineer.

D. All training material shall be furnished and supplied by the Contractor.

1.14. QUALITY ASSURANCE

A. The Contractor and Contractor's personnel shall be experienced, thoroughly trained and completely familiar with the systems, equipment, devices, fixtures, materials, etc. and the required methods of installation.

B. The Contractor shall provide, upon request, after bid opening and prior to notice to proceed, a company resume including a list of project personnel with years of experience and qualifications/certifications, a list of similar projects completed within the past 5 years with contact information for the Owners and Engineers for each project and any other information which may be pertinent to the project. If requested, the Contractor shall provide a similar resume for sub-contractors.

C. The Contractor shall provide proof, upon request, that all personnel are licensed according to Washington State RCW19.28.161.

D. All materials, equipment and workmanship shall be properly inspected by the Contractor and shall at all times be subject to inspection by the Owner, Architect and Engineer. Contractor shall provide all samples, data and documents necessary for such inspection. Owner, Architect and Engineer shall be afforded full and free access at the jobsite and the shops and places of business of the Contractor for such inspection and to determine the status of the work. If Contractor covers all or any part of the work prior to any inspection or test specifically requested by Owner, Architect and/or Engineer, the cost of any necessary uncovering and replacing shall be borne by the Contractor.

E. Neither the failure to make inspections or tests, nor to discover defective workmanship, materials or equipment, shall prejudice the rights of the Owner, Architect or Engineer thereafter to reject the work and/or require its correction.

F. The completed installation shall comply with the more stringent of the requirements of the drawings and specifications, the authorities having jurisdiction, and all laws, ordinances, rules, regulations and requirements in effect at the site, including current editions of the following:

1. NEC - National Electrical Code.
3. OSHA - Occupational Safety and Health Act (and its Washington State equivalent).

G. The following standards establish the minimum requirements for the equipment and installation, unless exceeded by the requirements of the drawings or specifications:

2. BICSI – Building Industry Consulting Service International
3. ICEA - Insulated Cable Engineers Association.
4. IEEE - Institute of Electrical and Electronics Engineers.
5. NEMA - National Electrical Manufacturers Association.
6. NEIS – National Electrical Installation Standards
8. NECA – National Electrical Contractors Association

H. In addition, telephone/voice & computer/data pathways & wiring shall be in accordance with the current edition of the following:

1. ANSI/NECA/BICSI 568 – Installing Commercial Building Telecommunications Cabling.
2. ANSI/TIA/EIA 526 – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
10. ANSI/TIA/EIA 598 – Optical Fiber Cable Color Coding.
12. ANSI/TIA/EIA 607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.
I. Nothing in the drawings or specifications shall be construed to direct or permit work not conforming to applicable laws, ordinances, rules, regulations, requirements or standards. Discrepancies or conflicts shall be brought to the attention of the Owner and Engineer promptly for resolution.

J. The Owner and Engineer shall be advised prior to any inspection being requested. The Owner and Engineer shall be provided the opportunity to inspect the installation prior to wallboard, ceiling or finish installation. Any materials, equipment or workmanship that is not (in the opinion of the Owner, Engineer or Inspector) as it should be, shall be taken out and replaced without cost to the Owner.

PART 2 - PRODUCTS

2.01. GENERAL

A. Coordinate the features of materials and equipment so they form an integrated system.

B. Contractor shall make certain that all materials selected by him, his subcontractors or by his suppliers, conform exactly to requirements of the drawings and specifications. Transmittal of such specifications and drawing information to subcontractors, persons manufacturing and/or supplying materials to the project, and rigid adherence thereto, is the Contractor's responsibility.

C. All equipment, devices, luminaires, materials, etc. shall be UL (Underwriter's Laboratories, Inc.) listed, labeled and approved for the service intended where UL standards have been established. If no UL label is available, the label of a testing agency or conformance to national standards recognized and approved by the electrical inspector having jurisdiction is required.

D. All equipment, devices, fixtures, materials, etc. shall be new and installed only if in first class condition.
   1. Unless specifically designated as existing.
   2. Existing raceways, boxes, etc. may be re-used if in "like new condition" and appropriate for the new installation.

E. All equipment, devices, etc. and their components shall be designed for continuous duty without degradation of function or performance.

F. In the event that any item is not available exactly as specified, the Contractor shall so notify the Owner and Engineer in writing prior to bidding as early as possible to allow ample time for an alternate item to be selected without delay to the project.
2.02. EQUIPMENT MANUFACTURERS

A. Unless specifically noted otherwise, all references to manufacturer's or supplier's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

B. All equipment, devices, materials, etc. shall be of a type manufactured by reputable recognized vendors. Each type or groups of items, system components, etc. having the same or similar function shall be the same manufacturer, make and quality throughout the facility.

C. Approval of a manufacturer's name and/or type does not release the Contractor of the responsibility for providing materials which comply in all details with requirements in the contract documents.

2.03. SPARE CAPACITY

A. Unless sizes and/or quantities are specifically indicated, provide at least 20% spare wiring capacity in all cabinets, panels, cable trays and raceways.

2.04. ENCLOSURES

A. Equipment, devices, luminaires, boxes, etc. located indoors shall have general purpose (NEMA 1) enclosures.

B. Equipment, devices, luminaires, boxes, etc. located outdoors shall be provided with weatherproof (NEMA 3R) enclosures. Surface finish shall be a rust inhibiting primer followed by an epoxy or polyurethane polyester top coat.

C. Provide gaskets, seals, etc. as required to prevent the entrance of moisture, debris, insects, etc.

D. Enclosures and boxes shall be fabricated from code gauge, or heavier, galvanized steel. Surface preparation and finish shall be manufacturer's standard unless noted otherwise.

E. Include all necessary mounting, etc. accessories.

2.05. SUPPORTS AND CHANNEL

A. Channel, framing members, etc. shall be 12 gauge steel, galvanized, 1 5/8 inch channel width with all necessary accessories.

B. Threaded rod shall be steel, minimum 3/8 inch diameter.
2.06. EQUIPMENT BACKBOARDS

A. Equipment backboards shall be \( \frac{3}{4} \) inch plywood, void free, interior grade, good one side, fire resistant treated, bearing a quality mark indicating compliance with American Wood Preservers Assoc. (AWPA) standards.

B. Paint with minimum two coats of light colored fire resistant paint on all sides and edges.

2.07. ANCHORS AND FASTENERS

A. Anchors and fasteners used shall be of a type designed for use in the base material to which the item is to be attached. Attach to wood with wood or lag screws, to metal with machine screws or bolts and to concrete with carbon steel wedge or sleeve type expansion anchors or self-drilling metal anchors and machine screws or bolts.

B. Pad and floor mounted equipment shall be secured with suitable hot dipped galvanized steel anchor bolts, washers, hex nuts, etc.

C. Powder actuated fasteners, plastic expansion type anchors, nails and toggle bolts are not permitted.

D. Anchors shall be non-corrosive or have suitable corrosion resistant coatings or treatment.

E. Bolts, nuts, screws and other threaded devices shall have standard threads and heads, unless required for tamper-proof installation.

2.08. IDENTIFICATION

A. Provide nameplates for all equipment (e.g. switchboards, panels, disconnecting means, control panels, control stations, etc.) and other devices used for the control of circuits, equipment, etc. Nameplates shall adequately describe the function or operation of the identified equipment, devices, etc. and include the panel and circuit number(s) from which it is fed. Nameplate designations shall be consistent with the project documents. Submit proposed inscriptions for approval.

B. Provide nameplates for switchboards and panelboards to identify the system color coding scheme for phase and neutral conductors as required.

C. Definite purpose devices shall be labeled with a description of the device's function, rating and include the panel and circuit number(s) from which it is fed.

D. All equipment and outlets shall be labeled with the panel and circuit number(s) from which it is fed.

E. Spare, C.O., etc. conduits shall be labeled with their destination.

F. Nameplates shall be laminated plastic, with lettering etched through the outer covering. Character size as appropriate for the application, approved by Engineer; \( \frac{1}{4} \) inch except
minimum 1/8 inch. Nameplates shall be securely fastened with suitable adhesive or self tapping screws. Character and background colors shall conform to the following system color code:

<table>
<thead>
<tr>
<th>Background</th>
<th>Char.</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>White</td>
<td>Power &amp; Lighting</td>
</tr>
</tbody>
</table>

G. Identification tags shall be plastic, flexible type with a label. Identification tags shall be securely fastened with cable ties. Tags shall be mounted so as to be clearly visible.

H. Labels shall be heavy duty adhesive type, clear background with black letters on light colored devices and clear background with white letters on dark colored devices; except, labels on devices connected to the emergency power system shall have red letters. Lettering shall be appropriately sized for the application, ¼ inch except minimum 1/8 inch. Labels on ceiling mounted devices shall be large enough to read from the floor. Labels shall be as manufactured by Kroy, Brothers, or approved equal. Self-adhesive circuit numbers, masking tape, plastic punch type "Dymo" labels, etc. are not acceptable.

PART 3 - EXECUTION

3.01. CONSTRUCTION/WIRING METHODS

A. Wiring methods shall be as follows:

1. Feeders - PVC conduit below grade (with GRS conduit risers and RTRC fiberglass elbows) and EMT above grade.

2. Branch circuits - PVC conduit below grade (with GRS conduit risers and RTRC fiberglass elbows for conduits 2" and larger) and EMT above grade.

3. Telecommunications - PVC conduit below grade (with GRS conduit risers and RTRC fiberglass elbows) and EMT above grade.

4. Class 2 control, etc. - PVC conduit below grade (with GRS conduit risers and elbows) and EMT above grade.

B. All wire and cable shall be enclosed within the raceway system; except, "open cable wiring" will be permitted for Class 2 signal and control, telecommunications, etc. cables approved for the purpose when run concealed in an accessible location above the ceilings or in the attic.

C. Conduit and cable shall be run concealed in the walls (including within CMU and similar construction), above the ceiling, or below the floor with all devices, etc. flush mounted; except, in the Mechanical and Electrical Rooms, conduit drops to panels, equipment, etc. may be run exposed.
D. Raceways and cables shall be run concealed in the walls (including within CMU and similar construction), soffits (new and existing), above the ceiling or below the floor unless indicated otherwise; except, exposed within utility rooms and other similar type spaces. Raceways may be run exposed within public spaces, classrooms, offices, and the like only where indicated and with prior approval of the Owner and Architect. Exposed raceways shall be run as neatly and unobtrusively as possible, to the approval of the Owner, Architect and Engineer.

E. Equipment shall be surface mounted unless noted otherwise.

F. Devices, etc. shall be flush mounted unless noted otherwise.

3.02. CONTRACTOR CONTROL AND SUPERVISION

A. Contractor shall supervise and direct the Work, using its best skill and attention, and shall perform the work in a skillful 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. Performance of the work shall be directly supervised by a competent superintendent (and/or foreman) who is satisfactory to Owner and has authority to act for Contractor. The superintendent (and/or foreman) shall constantly supervise the work and check all materials prior to installation for conformance with the Contract Documents. The superintendent (and/or foreman) shall not be changed without the prior written consent of Owner.

C. Contractor shall enforce strict discipline and good order among Contractor's employees and other persons performing the Work. Contractor shall not permit employment of unfit persons or 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.

D. Inappropriate activity or comments by Contractor, Contractor's employees and other persons performing the work will result in immediate removal from the site.

3.03. GENERAL

A. The installation shall be done in a neat and workmanlike manner and shall be suitable for the location. Conduit stub-ups, sleeves and ends left open for future connection, unused hubs in fittings and unused holes in boxes shall be plugged or capped to prevent the entrance of moisture and debris.

B. For the actual fabrication, installation and testing use only persons thoroughly trained, experienced and completely familiar with the items required and with the manufacturers' recommended methods of installation. In acceptance or rejection of the work, no allowance will be made for lack of skill or experience.
C. Circuits shall be run from equipment to equipment, outlet to outlet, luminaire to luminaire, device to device, etc. and all homeruns shall be run as shown on the drawings unless permission is obtained from the Engineer to alter the arrangement.

D. Changes in location (e.g. equipment and devices up to 10 feet, trench and raceway routing, cable tray locations, etc.) made before installation and deviations to avoid interferences shall be made without increase in Contract Sum.

E. The Contractor shall conduct operations in a manner to avoid the risk of bodily harm to persons or damage to any property. Construction equipment and tools shall be in good operating condition and be designed to perform the work required. The Contractor shall continuously inspect all work to discover any unsafe conditions and be solely responsible for their correction.

F. Use all means necessary to protect the equipment and materials and the work, materials, etc. of the other trades before, during and after installation. Do all cutting carefully to prevent damage to the work. Correct lifting, jacking and/or moving methods shall be used. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and Engineer without increase in Contract Sum.

G. The Contractor shall provide all cutting, patching, core drilling, etc. as required for the work. Use only journeymen skilled in the necessary cutting or patching operation. Patching shall match adjacent work. Structural members shall not be cut without approval of the Architect. Where penetrations in structural members for conduits, cables, etc. are allowed, the holes shall be no larger than absolutely necessary.

H. Contractor shall x-ray or otherwise determine the exact location of existing structural components, conduits, piping, wiring, ducts and the like prior to making any new penetrations or openings (or expanding existing openings) in any floor, wall or ceiling.

I. The premises shall be kept free from the accumulation of rubbish and debris caused by the work. Dust, fibers, debris, etc. caused by the work shall be cleaned up immediately (prior to the worker leaving the area, room or space) and not tracked to other areas, rooms, spaces, etc. Cleanup shall be with a vacuum cleaner or similar provided with a proper HEPA filter.

J. The Contractor shall provide all backboards, hangers, supports, chases, anchor bolts, inserts, sleeves and other openings in the construction required for the electrical work.

K. The Contractor shall move existing equipment, furniture, bookcases, boxes, miscellaneous (office, storage, maintenance, etc.) objects and materials, and other building furnishings, attached or unattached, as required to perform the work, including returning the items to their original location in their original condition.

3.04. PROTECTION OF PERSONS, FACILITIES & UTILITIES

A. Provide devices and methods and proceed with sufficient caution to preclude damaging any facilities, utilities (e.g. power, water, sewer, natural gas, telecommunications, etc.) or similar, above ground or underground, concealed or exposed, known or unknown, located or not located. In the event unidentified utilities are encountered, notify the utility, Owner and Engineer.
B. Unless otherwise provided by the drawings or specifications, do not cut or alter any existing utility or similar without authorization of the Owner and Engineer. The Contractor shall pay all costs, as determined by the Engineer, of remedial work necessitated by unauthorized or accidental cutting, patching, trenching, excavating, backfilling, etc. which damages and/or impairs the performance of existing utilities or similar (e.g. power, water, sewer, natural gas, telecommunications, etc.), above ground or underground, concealed or exposed, known or unknown, located or not located.

C. All such work shall be verified with Owner and Engineer before execution of replacement, re-routing, relocation, repair or termination commences.

D. Notify Regulating Agencies, Locator Service, Utility Companies, Engineer and Owner’s Project Manager a minimum of fourteen (14) days in advance and re-confirmed a minimum of 48 hours in advance, or as mutually agreed upon with Owner, prior to commencement of any such work. Submit procedures to assure safe and continuous operation of the utilities for approval.

E. Proceed with sufficient caution to preclude damaging any utilities or similar (e.g. power, water, sewer, natural gas, telecommunications, etc.), above ground or underground, concealed or exposed, known or unknown, located or not located. In the event unidentified utilities are encountered, notify the utility, Owner and Engineer.

F. Provide a spotter at all times when excavation occurs by use of a backhoe or other mechanical equipment.

G. Provide adequate means of support and protection during earthwork operations.

H. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Owner and utility, without increase in Contract Sum.

I. Damaged electrical and telecommunications (telephone, computer/data, television, fiber, copper, etc.) cables shall be replaced in their entirety. Splicing will not be allowed.

3.05. COORDINATION AND SCHEDULING

A. The Contractor shall coordinate the work and cooperate with the Owner, other trades and System Contractors to have the work completed to the best advantage, insure there are no interferences, provide reasonable opportunity for the other trades and Contractors to complete their work and to not delay the work.

B. Contractor shall coordinate work to avoid disturbance to building operations and personnel, and to allow access for both persons to and within all portions of the facility and vehicles to the facility. Access to office spaces, classrooms, etc. will not be allowed when they are occupied. (Note that the offices, classrooms, etc. in areas other than the remodeled area will be occupied and in full operation.) Contractor shall coordinate and schedule with Owner’s representative, department heads and the occupants of the individual space a minimum of fourteen (14) days
in advance and re-confirmed a minimum of 48 hours in advance, or as mutually agreed upon with Owner, to determine dates and times that access to the Contractor will be allowed.

C. Work in private offices, computer rooms, classrooms and the like shall only be done with the occupant’s approval and at his or her convenience.

D. Contractor shall schedule all equipment, utility, electrical, telecommunications, fire alarm, fire protection, etc. interruptions with the Owner in accordance with the scheduling requirements in Section 01500. Interruptions and closures shall not be extended overnight.

E. Contractor shall schedule building closures, complete or partial, with the Owner in accordance with the scheduling requirements in Section 01500 (e.g. for x-raying).

F. Any and all costs incurred for non-standard hours, double-shifts, overtime, etc. or any other costs associated with completing the project within the completion times required shall be included without increase in contract sum.

3.06. DELIVERY, STORAGE AND HANDLING

A. All equipment and materials shall be stored neatly and out of the way. Conduit, fittings, cable, etc. shall be stored off the ground, protected from the weather in racks or bins or on shelves. Equipment, panelboards, fixtures, devices, etc. shall be stored indoors in a dry, warm area, free of dust and one in which condensation will not occur.

B. Ship equipment in its original package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer's recommendations and packing label instructions. Provide protective coverings during construction.

C. Following installation, protect materials and equipment from corrosion, condensation, physical damage, and the effects of moisture. Keep openings in boxes or equipment closed when work is not being done in them during construction.

D. Identify materials and equipment delivered to the site and storage organized to permit checking against approved material lists and submittals.

3.07. TEMPORARY POWER

A. The Contractor shall provide all temporary power services, facilities, equipment, devices, material, etc. required for the construction; including adequate lighting, outlets, balancing, testing, etc. as may be necessary for the proper performance and inspection of the work.

B. Electrical power at 120 volts, 1 phase for operation of lighting, small power construction tools and light-duty equipment may be obtained from the existing buildings, free of utility costs. During power interruptions, and if Contractor's equipment will not operate on the available power, the contractor shall supply all equipment needed, such as transformer(s), generator(s), etc. and pay all costs involved.
C. The temporary power system shall be provided in a neat and safe manner, in compliance with governing codes and good working practice.

D. The temporary power system shall be removed when no longer required.

E. Any permanent 120V receptacles in the building which are used for temporary power during construction shall be replaced with new receptacles at the completion of the project.

3.08. INTERRUPTIONS

A. Power, fire alarm, telecommunications and other systems interruptions, whether to individual equipment or to the entire system, shall not be done without prior approval and scheduling with the Owner. Power, fire alarm and/or telecommunications interruptions required to facilitate construction work and that affect operation of the existing facility shall not be done during normal working hours. Some working of non-standard or longer than standard hours will be required, without increase in Contract Sum. Also, see Section 01500.

B. Power interruptions to panels and/or circuits feeding the existing telecommunications equipment, devices, etc. shall not exceed 1 hour, and then only during the lowest usage hours (typically between 11:00 p.m. and 6:00 a.m.).

C. Telecommunications services shall be maintained to each outlet in the entire facility whenever the space is occupied (e.g. the entire facility during normal operating hours, except the areas being remodeled). Therefore during non-operating hours, new cables shall be provided, new outlets connected and/or existing outlets re-connected from the existing cabling system to the new cabling system, cables terminated at the backboard, testing completed, cross-connects and migration completed, etc. and the systems returned to service before the space is occupied again.

D. In order to minimize the interruptions to the individual systems and equipment, and to keep maximum power available to the facility; the new service and power distribution system shall be completed and energized before the existing service is de-energized and removed.

E. Shutdowns will not be allowed to extend beyond the time Contractors personnel are present.

3.09. LOCATIONS

A. Locations and mounting heights of equipment, devices, etc. shall be consistent, and in accordance with the requirements of NFPA, ADA and the authority having jurisdiction.

B. Devices and associated wallplates shall be located so as to not span different types of building finishes.

C. In general, surface raceways, cable trays, cable racks, etc. shall be mounted as unobtrusively as possible, tight against whiteboard trim, chair rails, in room corners, against ceilings, against chases, etc. and other breaks in the construction.
D. Prior to rough-in, the Contractor shall mark or otherwise show the location of all equipment and devices, and the proposed routing of raceways. Obtain specific approval for the location of each from the Owner, Architect and Engineer before rough-in.

E. Changes in location (e.g. equipment and devices up to 10 feet, trench and conduit routing, etc.) made before installation and deviations to avoid interferences shall be made without increase in Contract Sum.

3.10. EQUIPMENT, LUMINAIRES AND DEVICES

A. Equipment, luminaires, devices, etc. shall be installed plumb and true, and shall be square with the adjacent walls, ceilings, structural members and other equipment; in a horizontal or vertical position as intended. The location of similar items shall be consistent.

B. Light standards (poles), luminaires, etc. shall be set to stand plumb and true and shall be square with the adjacent buildings, property lines, sidewalks, roadway, etc.

C. Equipment, cabinets, boxes, fixtures, devices, etc. shall be accurately mounted and leveled and be firmly supported either directly or indirectly by a sound and safe structural member of the building in accordance with manufacturer's instructions, or as directed. Supports shall be neatly placed and properly fastened. In addition to the weight of the equipment or material, allowance shall be made for vibration (e.g. motors and fans) and variable and/or shock loading from internal or external forces (e.g. operation of disconnect switches or circuit breakers).

D. The correct lifting, jacking and/or moving gear which will prevent damage shall be used.

E. All bolts, nuts, screws and other fastenings shall be tightened in accordance with manufacturers or listing instructions and all covers replaced on equipment and boxes. All electrical connections, particularly those on bus work in panelboards, etc. shall be checked to ensure tightness and electrical conductivity.

F. Follow manufacturer's installation details wherever available. Provide supports, boxes, mountings, wiring, fittings, etc. as required, standard or special. Wherever any conflict arises between manufacturer's instructions, codes and regulations, and these Contract Documents, follow Owner’s decision.

G. Following installation, protect materials and equipment from corrosion, condensation, physical damage, and the effects of moisture. Keep openings in boxes or equipment closed when work is not being done in them during construction.

H. Provide gaskets, seals, etc. as required to prevent the entrance of moisture, debris, insects, etc. Check for proper fit.

3.11. SUPPORTS

A. Provide all necessary supports, anchors, fasteners, and backing for all raceways, cable trays, cable racks, boxes, enclosures, fixtures and equipment.
B. Hangers and supports shall be made from standard structural shapes and hardware or systems of shapes, fittings and hardware designed for the purpose.

C. Hangers and supports shall be adequately and safely attached to the building structure. Equipment or materials to be supported shall be securely fastened to the supporting means. Use size and number of attachments as required for a safety factor of at least four. In addition to the weight of the material, consideration shall be given to the weight of the support itself, the weight of materials within, vibration, external operational forces, shock load, etc.

D. Brace all equipment, cable tray, cable racks, etc. as required to meet the requirements of Seismic Design Category D.

E. Attach to wood with wood or lag screws, to metal with machine screws or bolts and to concrete with carbon steel wedge or sleeve type expansion anchors or self-drilling metal anchors and machine screws or bolts.

3.12. CORROSION PROTECTION

A. All material and equipment shall have corrosion protection suitable for the atmosphere in which they are installed.

B. Maintain the integrity of factory provided corrosion protection. Repair damaged corrosion protection and touch-up paint all scratched, marred or damaged factory finish on equipment, devices, luminaires, enclosures, etc.; per manufacturer’s instructions where available.

C. Paint field cuts with a suitable cold galvanizing compound.

3.13. APPROVALS

A. Prior to rough-in, the Contractor shall mark or otherwise show the location of all equipment and devices, and the proposed routing of raceways, cables, etc. Obtain specific approval for the location of each from the Owner, Architect and Engineer before rough-in.

B. Prior to beginning installation of cables, obtain approval of concealed raceway installation from the Owner, Architect and Engineer.

C. Prior to beginning installation of cables, obtain approval of the raceway installation from the Owner, Architect and Engineer.

3.14. CLEANING

A. Remove trash, combustible material, and other debris from electrical rooms and areas around equipment.

B. Remove shipping materials, supports, spacers, etc. from equipment, devices, etc.
C. Remove all debris from equipment, devices, etc. including all scraps of wire, metal shavings, plaster, dust, and other foreign material.

D. The top sides and interiors of all equipment and enclosures shall be vacuumed clean.

E. The exterior of all equipment and enclosures shall be wiped down with a clean, dry, lint-free cloth or soft bristled brush.

F. Clean screens, louvers, baffles, etc. covering ventilation openings to ensure they are clear.

G. Remove paint splatters and other spots, dirt, and debris.

H. Touch up scratches to match original finish.

I. Remove all traces of soil, dirt, dust, smudges, fingerprints and other foreign matter from visible surfaces of equipment, devices, luminaires, etc. Pay close attention to highly finished surfaces such as glass and polished metals. Wipe lamps clean.

J. Maintain adequate ventilation during cleaning.

K. Follow manufacturer’s instructions. Failure to follow manufacturer’s recommendations when cleaning equipment can result in damage from the use of improper cleaning methods or agents.

3.15. VISUAL AND MECHANICAL INSPECTION

A. Verify that all equipment and their components are sized properly for the load and the types, sizes, etc. are in accordance with the contract documents, approved submittals, etc.

B. Visually inspect equipment for physical damage. Repair physical damage, if practical and approved by the manufacturer. Consult Owner, Engineer and manufacturer for recommendations for suitable protective barriers to prevent future damage.

C. Inspect molded and formed equipment and components (e.g. circuit breaker cases, fuses, starters, relays, insulators, supports, etc.) for cracks or other defects.

D. Check all bolts, connections, cable terminations, etc. for tightness using a calibrated torque wrench or screwdriver. Refer to manufacturer’s instructions and markings for proper torque values.

E. Visually check the equipment, its components and associated raceways, conductors, etc. for proper grounding and bonding. Ensure that grounding and bonding terminal bars, bus bars, straps, and conductors are properly connected.

F. Verify that cables do not contact live parts and that cables are properly secured to withstand the effects of fault currents.

G. Check equipment anchorage, mounting, clearances, alignment and fit of components.
H. Check that phase barriers are in place, if applicable.

I. Visually check disconnect switch blade alignment, blade penetration, travel stops, and mechanical operation.

J. Inspect each fuse holder to determine whether it seems to be adequately supporting the fuse and that the fuse holders are securely attached to the mounting base. Verify fuses are set tightly in the clips provided.

K. Operate equipment and components (e.g. disconnect switches, circuit breakers, etc.) to insure smooth operation.

L. Compare all circuits (internal and external) with wiring and/or control diagrams to verify they are installed correctly.

M. Confirm correct operation and sequencing of electrical and mechanical interlock systems, if so equipped. Attempt closure on locked-open devices. Attempt to open locked-closed devices.

N. Confirm that equipment nameplates and safety labels are provided.

3.16. TESTING

A. The Contractor shall perform all tests required in the various sections of the specifications and in accordance with manufacturer’s recommendations. Record test results and include in operation and maintenance manuals.

B. The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

C. All testing shall be performed by personnel that are trained in the specific task to be performed.

D. Do not proceed with tests until previously identified deficiencies are corrected.

E. Test equipment in accordance with manufacturer’s recommendations. Maintain test results for future comparisons. Include in operation and maintenance manuals.

F. Upon completion, all equipment and systems shall be tested for functional operation, including all intended modes and sequences of operation.

G. Readings of the voltage and amperage shall be taken on each phase at each panelboard and at the end of the longest branch circuit at no load and full load conditions.

H. All systems shall test free from shorts and grounds and shall be without mechanical and electrical defects. If any test indicates a failure, in the opinion of the Engineer; the item shall be replaced or suitably repaired to the approval of the Owner, Architect and Engineer, and the test repeated without additional cost to the Owner.
3.17. ENERGIZING

A. Energize equipment in accordance with manufacturer’s recommendations.

B. The Owner, Engineer and other affected personal shall be notified one week prior to energizing so that the energizing may be witnessed.

C. Energize equipment, feeders, circuits, etc. from the source end and working to the load. Close main devices, feeder devices, motor/branch circuit devices, etc. in sequence.

D. Verify all temporary grounding, etc. connections are removed prior to energizing.

E. Verify that all load disconnecting, etc. devices are open, padlocked and tagged prior to energizing.

F. After energization, equipment shall be observed for unusual conditions such as vibration, noise, excessive temperature rise, etc.

3.18. COMMISSIONING

A. Provide commissioning of the lighting control systems in accordance with the requirements of the latest edition of the Washington State Energy Code (WSEC).

B. The Contractor shall provide all test equipment, instruments, tools, etc. as required. Test equipment, instruments, tools, etc. shall be fully operational and properly calibrated.

C. All commissioning and testing shall be performed by personnel that are trained and fully qualified in the specific task to be performed. Qualifications shall include expert knowledge relative to the specific work involved, documentation and tools to service and test the equipment, and willingness to work with the Commissioning Agent(s) and/or Contractor(s) to get the work completed in a timely manner. The Commissioning Agent(s) and/or Contractor(s), Owner, Architect or Engineer reserve the right to judge the capabilities and qualifications of the proposed commissioning and testing personnel relative to each item of equipment and/or system.

D. Qualified representatives of the manufacturers shall assist in tests if deemed necessary by the Commissioning Agent(s) and/or Contractor(s), Owner, Architect or Engineer.

3.19. CONTRACT CLOSE-OUT

A. As a requirement for substantial completion of the Work, the Contractor shall thoroughly check the installation. Checking shall consist of visual inspection and manual adjustment to confirm correct installation and arrangement and to assure the intended function, response and operability. Checking shall include, as a minimum, the following:

1. Check that equipment, devices, etc. are of the correct type and rating.
2. Check that all raceways, fittings, devices, boxes, enclosures, etc. are secure and that all conduit connections are tight.

3. Check that all electrical connections are correctly tightened.

4. Check that equipment, devices, panelboard circuit directories, etc. are correctly labeled.

5. Check that equipment, fixtures, devices, etc. are clean with all unnecessary labels removed.

B. As a requirement for substantial completion of the Work, the Contractor shall:

1. Obtain final inspections from the authorities having jurisdiction.

2. Perform final cleaning.

3. Submit approved "As Built" Drawings, Record Documents, Test Records, Manuals, etc.

4. Submit written warranty statements for equipment, materials and installation.

5. Conduct system tests.

C. After the requirements for substantial completion have been met, the contractor shall notify the Engineer in writing that the Work is substantially complete. The Engineer will then perform a final inspection of the installation and issue a “punchlist” for final completion.

D. The Contractor shall complete the work on the punchlist or provide written explanation for not completing the work. The punchlist shall be signed by the contractor and returned to the Engineer when complete.

E. The Engineer will re-inspect the Work to verify that all the items have been completed.

F. The above process shall be completed a single time for the project. If additional punchlist and inspection cycles are required to be completed due to the contractors failure to complete items on the punchlist, the contractor will be backcharged for the Engineer's additional services on time and material basis through the construction contract.

G. Subsequent to final completion and testing operations, instruct Owner's authorized representatives as required in operation, adjustment and maintenance of equipment and systems.

End of Section 26 00 10
PART 1 - GENERAL

1.01. APPLICABLE PROVISIONS

A. The General, Supplementary and other Conditions of the Contract, modifications to the General Conditions, the Drawings, and the applicable provisions of the other Divisions are hereby made a part of this Division and all its sections.

1.02. SUMMARY

A. The requirements of this Section and the other Division 26, 27 and 28 Sections apply to all the electrical work.

B. Coordinate electrical work with related work shown and specified elsewhere.

C. Provide all materials necessary for the proper execution and completion of the work as herein specified or called for on the drawings. Required items not specifically mentioned in the specifications or indicated on the drawings shall be provided as necessary to produce the intended results.

D. In the event that any item is not available exactly as specified, the Contractor shall so notify the Engineer in writing as early as possible to allow ample time for an alternate item to be selected without delay to the project.

1.03. SUBMITTALS

A. Provide submittals for the following:

1. Floor boxes.
2. Exterior outlet boxes.
3. Electrical vault.
4. Warning Tape.
5. Low voltage cables.

PART 2 - PRODUCTS

2.01. RACEWAYS

A. Raceways, where required, shall be of the types listed below, unless noted otherwise:

1. Electrical Metallic Tubing (EMT) – Concealed above grade and exposed in Utility Rooms and other Non-Public Areas not readily visible to building occupants, except as noted below.

2. Polyvinyl Chloride (PVC) – below grade conduits, except as indicated below.
3. Fiberglass (RTRC) – below grade conduit elbows (for conduits 2 inch and larger).


5. Flexible Metal Conduit (FLEX):
   a. Final connections to vibrating equipment.
   b. Fixture whips.
   c. Substituted for EMT for branch circuits between wiring devices and boxes concealed inside frame walls and ceilings.
   d. FLEX shall not be used for any homeruns, conduit stub-ups into accessible ceiling spaces, nor for any exposed or surface conduit runs except as final connections to vibrating equipment.

6. Type MC Cable may not be used.

B. Raceways shall be sized so that the cable fill does not exceed 40%; except, minimum conduit sizes shall be as follows:
   1. 1/2 inch - runs with 3 or fewer #12, or smaller; except flex shall be minimum 3/4 inch.
   2. 3/4 inch – above grade branch circuits, ancillary systems circuits or similar, except as noted below.
   3. 1 inch – branch circuit homeruns.
   4. 1 inch – below grade.
   5. 1 inch – telecommunications circuits terminating in a single outlet.
   6. 3/8 inch - fixture whips furnished by the manufacturer with the fixtures.

C. PVC conduit shall be heavy-wall (Schedule 40), flame-retardant, suitable for use with 90°C cable, shall not distort from heat it will normally encounter and shall be resistant to low temperature and sunlight effects, impact and crushing.

D. Fiberglass (RTRC) conduit shall be Reinforced Thermoset Resin Conduit, wound fiberglass tubing, adhered with epoxy based resin, UV resistant, UL listed.

E. Galvanized rigid steel conduit (GRS) shall be hot-dipped galvanized with threaded couplings and connectors. Below grade steel conduits shall be coated with a suitable asphalt (or equivalent) compound for corrosion protection.

F. Electrical metallic tubing shall be electro-galvanized steel.
G. Flexible metal conduit shall be helically wound galvanized steel, type FMC; except outdoors, liquidtight flexible metal conduit shall have a liquidtight, non-metallic, sunlight-resistant jacket over a flexible galvanized steel metal core, type LFMC. Flexible conduit connections shall be a minimum of 18 inches long.

H. Conduit elbow radius and bends in conduits 2 inch diameter and smaller shall be not less than 6 times the conduit diameter, and in conduits 2 ½” and larger shall be not less than 10 times the conduit diameter; except for the following:

1. 24 inch maximum radius when turning vertically into the bottom of floor mounted equipment.
2. 24 inch maximum radius when turning vertically out of a trench with 24 inch cover.

I. Telecommunications (with or without cables), spare, c.o., etc. conduits shall be provided with pull rope below grade and pull string above grade.

J. Below grade telephone, computer/data, communications, spare, c.o., etc. conduits shall be plugged at both ends and their location properly marked.

2.02. RACEWAY FITTINGS

A. Fittings for steel conduit shall be steel, galvanized or cadmium plated, threaded type. Couplings shall be galvanized steel. Locknuts and bushings shall be galvanized steel.

B. Connectors, couplings, etc. for EMT shall be steel set-screw type; except, steel raintight compression type in potentially wet or damp locations (e.g. outdoors).

C. Conduit bodies (i.e., type T, LB, LR, LL) shall be cast metal bodies with threaded connectors and screw covers. Increase size or bodies if required for fill and bending radius.

D. Conduit bodies shall not be used in telecommunications system raceways.

E. Fittings, mounting brackets, etc. for surface metal raceways shall be grounding type, of the same manufacturer and specifically designed for the purpose and use with the particular type of raceway.

F. Fittings for flexible metal conduit shall be of a type specifically designed for the purpose.

G. Fittings for fiberglass (RTRC) conduit shall be of a type specifically designed for the purpose.

H. Fittings for nonmetallic conduits shall be of same manufacturer and material as the conduit.

I. End bells and/or insulated bushings shall be used on all underground conduit system terminations at vaults, junction boxes, padmounted equipment, etc.
J. “Open” ends of spare conduits terminating in vaults and in telecommunications rooms shall be sealed with expandable plugs to prevent movement of air and water between spaces. Plugs shall be water and gas tight, with high-impact plastic components, elastic expandable gaskets and pull rope eyelet.

K. Conduit terminations at equipment, etc. shall be suitably sealed and/or plugged at both ends to prevent the entrance of moisture. Spare, c.o., etc. conduits shall be provided with removable gasketed covers at the high end to prevent the flow of moisture from one box to another.

L. “Open” end of ancillary, telecommunications, spare, c.o., etc. conduits shall be provided with insulated bushings.

M. “Open” ends of telecommunications conduits entering the telecommunications room shall be provided with bonding bushings & bonded to the ground bar.

N. Telecommunications conduits entering the telecommunications room floors shall extend up from the floor between 1” and 3”.

O. Telecommunications conduits entering the telecommunications room walls and ceilings shall extend a maximum of 2” into the room.

P. Connectors at sheet metal enclosures shall have insulated throats.

Q. Openings in surface metal raceways, etc. through which cables are intended to pass shall be provided with suitable nonmetallic grommets before installing cable.

2.03. BOXES

A. The use of exposed boxes in areas readily visible to building occupants shall be kept to a minimum. Except in telecommunications raceways, use conduit outlet bodies (e.g. T, LB, LR, etc.) at conduit intersections unless specifically noted or approved otherwise.

B. Boxes shall accommodate any devices to be installed and shall be sized as required by the applicable codes for number and size of conduits and cables entering and leaving; except minimum as noted below.

C. Indoor boxes above grade in dry locations shall be standard stamped galvanized steel type, suitable for embedment in concrete and/or masonry where required.

D. Exterior outlet boxes shall be flush mount and contain surface metal weatherproof while-in-use covers, gaskets, mounting rings, and all necessary mounting accessories. Provide trim rings suitable for use with the type of siding or exterior building wall material. Boxes shall be Intermatic model WP1010MC or approved equal.

E. Unless noted otherwise, boxes installed in wet or damp locations and outdoors shall be threaded rigid body type, cast aluminum or galvanized iron.
F. Unless noted otherwise, larger size pull and junction boxes shall be fabricated from code gauge galvanized steel.

G. Unless noted otherwise, larger size pull, splice and terminal boxes shall be fabricated from code gauge galvanized steel, with full access screw type cover unless noted otherwise. Sizes shall be as required, except minimum as indicated. Terminal boxes shall be provided with power distribution type terminal blocks, with main and branch lugs sizes and quantities as required.

H. Switch, power outlet, device, etc. boxes shall be single or ganged to accommodate the required number of devices; except, flush mounted boxes shall be minimum 4 inches square for conduits 1 inch or less and 4 11/16 inches square for larger conduits. Boxes containing a single device shall be minimum 1 1/2 inches deep. Boxes containing multiple devices shall be minimum 2 1/8 inches deep. Flush mounted boxes shall be equipped with plaster rings and suitable wallplates. Surface mounted boxes shall have raised surface type covers.

I. Telecommunications, etc. outlet boxes shall be minimum 4 11/16 inch square by 2 1/8 inches deep, equipped with single-gang plaster rings and proper wallplates. Provide a 1 inch EMT conduit up to an accessible location above the ceiling or to the telephone terminal board from each outlet box unless noted otherwise.

J. Junction and pull boxes shall be sized as required by the NEC except the minimum size shall be 4 inch, square or octagonal as required, by 1 1/2 inches deep. Junction and pull boxes shall have full-access screw covers.

K. Floor Boxes:

1. Stand-alone floor boxes shall be "in floor" type, corrosion resistant, steel (with an epoxy coating), 8 gang, rectangular, 6" deep, water and concrete tight, fully adjustable before and after concrete pour. Wiring/device compartment shall be rectangular, minimum with space for 2 duplex power receptacles and 2 telecommunications faceplates located inside the compartment. Include device brackets, grommets, and all necessary accessories. Floor boxes shall be Wiremold Evolution type or approved equal.

2. Covers shall be die-cast aluminum with painted black finish, flanged, UL scrub water approved with dual blank access doors and no carpet/tile cutouts. Covers shall be Wiremold Evolution type or approved equal.

L. Ancillary systems outlet, device, junction, etc. boxes shall be in accordance with the requirements of the respective supplier; except, minimum as specified above.

M. Boxes shall be equipped with mud rings where required and proper wallplates and/or covers.

N. Unused flush mounted boxes, including existing abandoned in place, shall have blank wallplates or ceiling box type covers. Color shall match existing surface paint color as close as possible with manufacturer's standard colors.
O. Openings in boxes, etc. through which cables are intended to pass shall be provided with suitable nonmetallic grommets.

2.04. VAULTS

A. Electrical pull vaults shall be precast concrete, 2'8" wide x 3'8" long x 3'0" deep, solid base, 1-piece cover, 3'0" x 2'0" locking galvanized steel entrance cover, knockouts, drains, etc. Utility Vault Co. #233-LA with #23-2436P cover.

B. Mounting hardware (unless specifically noted otherwise), bolts, nuts, washers, etc. shall be stainless steel. All steel parts (except stainless steel) shall be hot-dipped galvanized after fabrication.

2.05. WIRE AND CABLE

A. Wire and cable sizes indicated and/or specified are minimums only and shall be increased as required due to NEC, system, load, voltage drop, etc. requirements.

B. All wire and cable (power, control, ancillary systems, etc.) installed in below grade conduit shall be suitable for wet locations.

C. All wire and cable (power, control, ancillary systems, etc.) shall be suitable for wet or dry locations, in conduit, above ground and underground.

D. Ground electrode conductors shall be copper, bare below grade.

E. Service and below grade feeder cable shall be single conductor stranded copper with 600 volt type USE/RHH/RHW insulation.

F. Branch circuit cable, above grade feeder cable and equipment ground cable, where run in raceways, shall be single conductor copper with 600 volt type XHHW or THWN/THHN insulation. The minimum conductor size shall be #12 AWG; except, fixture whips provided as an assembly by the fixture manufacturer with the fixtures may be #14 AWG. Conductors shall be stranded.

G. Line voltage (Class 1) control cable shall be single conductor stranded copper with 600 volt type XHHW or THWN/THHN insulation. The minimum conductor size shall be #14 AWG.

H. Low voltage (Class 2) control cable shall be single conductor copper with 600 volt type XHHW or THWN/THHN insulation if installed in conduit. Low voltage (Class 2) control cable run "open" shall be multi-conductor copper with 300 volt insulation and an overall jacket, type CL2, listed as being resistant to the spread of fire. The minimum conductor size shall be #16 AWG.

I. Cords shall be multi-conductor stranded copper with a green insulated grounding conductor, 600 volt type SO insulation and an overall neoprene jacket. The minimum conductor size shall be #14 AWG.
J. Fixture cable, where supplied by the Contractor, shall be stranded copper with 600 volt type PF insulation.

K. See section 27 05 00 for Communications Systems cables.

L. Color coding for power cable shall be as follows:

1. 208Y/120 volt, 3 phase, 4 wire: Phase A = black, B = red, C = blue, N = white;

2. Equipment ground cables shall be green.

3. Switch legs shall be the same color as the phase conductors. Switch travelers shall be purple.

M. Cable pulling lubricants shall be gel type, of the best quality and shall not have any damaging effect on the insulation. (Ideal Yellow 77 is not approved.)

2.06. CABLE SUPPORTS

A. Cable ties shall be utilized in panelboards, etc. to group and support conductors. Multi-wire branch circuits shall be grouped together as required. All cable shall be fanned-out to terminals and identified by labels; or, if terminated on circuit breakers or control devices, by typewritten indexes or nameplates.

2.07. CONNECTIONS AND TERMINATIONS

A. Taps and splices shall be kept to a minimum.

B. Taps and splices in #8 AWG, and smaller, branch circuit cable shall be made with twist-on spring type wire nuts. Taps and splices in telecommunications cables, ancillary systems cables, larger branch circuit cables, feeder cables, control cables, etc. or below grade will not be allowed without specific approval from the Engineer.

C. Taps and splices in #8 AWG and larger cable, where allowed, shall be made with proper size squeeze-type copper compression tap and splice connectors. (Mechanical set-screw type connectors will not be allowed.) Wrap completely with suitable electrical insulating tape or shrink-wrap in accordance with manufacturer's instructions.

D. Fuseholder splices for use in lighting poles and handholes shall be water proof, copper crimp style, non-breakaway in-line fuseholders, with quantity of terminals and fuses as required. Fuseholders shall be Bussmann Tron HEB Series, or equal.
2.08. WARNING TAPE

A. Yellow 3" wide polyethylene metalized warning tape shall be direct buried 12 inches above the topmost underground conduits. For multi-use excavations and trenches, provide multiple tapes.

B. Tape shall be printed with the words:
   1. "Caution, Buried Power Line Below" or similar above electrical conduits.
   2. "Caution, Buried Lighting Line Below" or similar above lighting conduits.
   3. "Caution, Buried Data Line Below" or similar above telecommunications conduits.

2.09. PULL STRING AND ROPE

A. Telecommunications (with or without cables), spare, c.o., etc. conduits shall be provided with pull rope below grade and pull string above grade.

B. Pull string shall be resistant to rot and mildew and shall not deteriorate when exposed to oil, grease, etc.

C. Pull rope shall be twisted polypropylene treated with ultraviolet stabilizers, minimum \( \frac{1}{4} \) inch diameter. Rope shall be resistant to rot and mildew and shall not deteriorate when exposed to oil, grease, etc.

D. Pull rope shall be flat, woven polyester tape, minimum 1800 tensile strength. Rope shall be pre-lubricated to reduce pulling tension and shall be durably printed with sequential footage markings. Rope shall be resistant to rot and mildew and shall not deteriorate when exposed to oil, grease, lubricants, etc. Where installed in underground conduits, the pull rope shall have a # 22AWG detectable tracer wire woven into the tape. Pull rope shall be Neptco Muletape, or equivalent.

2.10. CONCRETE

A. Concrete shall be ready-mix type, minimum 5\( \frac{1}{2} \) sack, 1 inch maximum aggregate size, 4 inch maximum slump, developing 3000 psi strength at 28 days.

B. Concrete exposed to weather shall be air entrained.

C. Testing is not required.
PART 3 - EXECUTION

3.01. RACEWAYS

A. Raceways shall be run concealed in the walls (including within CMU and similar construction), soffits (new and existing), above the ceiling or below the floor unless indicated otherwise; except, exposed within utility rooms and other similar type spaces. Raceways may be run exposed within public spaces, classrooms, offices, and the like only where indicated and with prior approval of the Owner and Architect. Exposed raceways shall be run as neatly and unobtrusively as possible, to the approval of the Owner, Architect and Engineer.

B. Raceways shall be installed straight, plumb and true and shall be without kinks or sags.

C. Exposed raceway runs shall be either parallel or at right angles to walls and structural members, as neatly and unobtrusively as possible (e.g. adjacent to window and door trims and base, at wall/wall or wall/ceiling intersections, etc.). Exposed parallel or banked raceways shall be run together.

D. Below grade conduits shall be direct buried between 24 and 30 inches below grade (except, conduits below the building concrete floor slab may be run immediately below the floor) and/or as required to bury conduits below footings, grade beams, etc., and spaced a minimum of 2 inches between conduits.

E. Below grade conduits shall be direct buried between 24 and 30 inches below grade and spaced a minimum of 2 inches between conduits, except:

1. Conduits below the building concrete floor slab may be run immediately below the floor) and/or as required to bury conduits below footings, grade beams, etc.,

F. Underground conduits extending into the building and at transformers, panels, etc. shall be suitably sealed or plugged at both ends. Sealant shall be removable. Ductseal is not acceptable.

G. PVC conduit shall be solvent welded to prevent the entrance of moisture.

H. Below grade telecommunications, low voltage control and instrumentation conduits shall be separated a minimum of 12” horizontally from below grade power conduits.

I. Junction boxes mounted above accessible ceilings shall be within 42 inches of the ceiling and shall have a minimum 12 inch clearance in front of the box.

J. Raceways shall be located to not interfere with the removal of pipes or equipment for maintenance or repair. All raceways shall be kept a minimum of 6 inches away from items producing heat.
K. Above grade raceways, fittings, etc. shall be securely supported from permanent structural members of building, either directly or indirectly. Raceways shall be fastened at intervals of 8 feet, nominally, and within 36 inches of each outlet, fitting, panel, etc. Raceway shall be supported using straps, hangers, clips or clamps specifically intended for use as raceway support. Single runs of exposed conduit shall be supported with steel pipe straps.

L. Bends in raceways shall be made without flattening, kinking or reducing the cross-sectional area of the raceway. Bends in parallel or banked runs shall be made from the same center line so that the bends are parallel.

M. All raceway cuts shall be made square with a proper cutting tool. The inside and outside of all raceway ends shall be reamed after cutting and/or threading to eliminate burrs and rough edges, then wiped clean. Joints shall be cut square and shall butt solidly into couplings. Running threads will not be permitted.

N. Raceways shall be closely and tightly fitted in couplings, connectors, boxes, etc. to provide an electrically continuous low resistance ground fault return path. Threaded joints shall be made up with at least 5 threads fully engaged.

O. The raceway systems shall be complete (including the installation of bushings, grommets, etc.), snaked and cleaned, and approval of the installation is obtained from the Owner and Engineer, before installation of any wallboard where the raceway is concealed in walls and above ceilings.

P. The raceway systems shall be complete (including the installation of bushings, grommets, etc.), snaked and cleaned, and approval of the installation is obtained from the Owner and Engineer, before or pulling any cable.

Q. Exposed raceways shall be painted.

R. Below grade telecommunications, spare, c.o., etc. conduits shall have their location properly marked.

3.02. VAULTS

A. Vaults, handholes, etc. shall be installed plumb and true and shall be square with the adjacent buildings, property lines and roadway. The location of similar equipment shall be consistent.

B. Prior to excavation, the Contractor shall mark or otherwise show the location of all equipment, vaults, handholes, etc. and obtain specific approval from the Owner and Engineer for the location of each.

C. Vaults and handholes bedding material shall consist of a minimum of 3 to 6 inches compacted sand or gravel, graded level. Backfill shall be good compactable material without large rocks, chunks or sticks. Backfill shall be progressively compacted from the bottom to the top surface to 95% of maximum density, and shall be without voids.
D. Lids, conduit and cable entrances, etc. shall be suitably sealed and/or grouted to prevent the entrance of moisture.

E. Conduit into vaults and handholes shall extend no more than 5 inches and no less than 3 inches from the bottom of the box surface. Care shall be taken to assure a neat and convenient arrangement.

F. Core and/or saw cut vaults for conduit entrances.

G. Provide vault drains, sump, etc. as indicated (see civil drawings).

H. Vaults shall be drained from at, or near, its bottom to the nearest point in a storm drainage ditch below the level of the vault base. Provide suitable rodent screen on the end of each drain.

3.03. EXCAVATION AND BACKFILLING

A. Excavate to depths noted, and as required for proper completion of all below grade work and cut to sufficient size to provide ample room for construction of forms, shoring and bulkheads as required.

B. Cut existing asphalt, concrete, etc. as required. Push under existing curbs, sidewalks, etc. where possible.

C. Underground utilities (electrical, water, sewer, cable television, etc.) are known to exist in the area of construction. The location of existing utilities shown on the drawings is approximate only and is not guaranteed to be an indication of all utilities in the area. The contractor is responsible for contacting the Owner and all utility companies and for field location of all utilities prior to construction. The one-call number for underground utility location services is 811 (1-800-424-5555). The Contractor shall promptly notify the Engineer of any conflicts between the contract documents and field location of existing utilities. The Contractor is responsible for maintaining the integrity of all existing utilities during construction.

D. Damaged electrical and telecommunications (telephone, computer/data, television, fiber, copper, etc.) cables shall be replaced in their entirety. Splicing will not be allowed.

E. Provide a spotter at all times when excavation occurs by use of a backhoe, excavator or other mechanical equipment.

F. Shore and brace excavations where necessary to prevent cave-ins and in accordance with all safety laws and codes.

G. During excavations and backfilling, extreme care shall be taken to keep rocks and other rough material away from conduits and cables. Pack a minimum of 6 inches of soft fill material (free from stones, rocks and other rough material that might be forced against the conduits and cables during backfilling, or when settling or frost-heaving disturbs the surrounding earth) around conduits and cables. Wash in to avoid air gaps.
H. Backfill shall be good compactable material without large rocks, chunks or sticks. Backfill in all excavations shall be progressively compacted in maximum 12 inch lifts to 95% of maximum density, and shall be without voids.

I. Prior to excavation, the Contractor shall mark or otherwise show the location of all equipment and vaults, and obtain specific approval from the Owner and Engineer for the location of each prior to installing equipment, boxes, raceways, etc.

J. Maintain all bench marks, control monuments and stakes, whether newly established by Surveyor or previously existing. Protect from damage and dislocation. If necessary to disturb existing benchmark, re-establish in a safe place.

K. The clearance between the underground conduit systems and other underground items, such as water and sewer lines shall be as large as necessary to permit maintenance of any of the systems without damage to the other items.

L. Keep all excavations, pits, trenches, etc., entirely free from water. Protect excavations from rain or water from any source during construction. Use suitable pumping equipment or other means as required by conditions. Continue pumping as necessary until completion of work.

M. When operations are interrupted by unfavorable weather conditions, prepare areas by grading and compaction to avoid ponding and erosion.

N. Dirt shall not be permitted to accumulate on roads or adjacent green belts, nor to be washed into drainage ditches.

O. Appropriate steps, such as the application of water, shall be taken to prevent airborne dust due to the work, particularly during excavation and moving of materials.

P. Trenches, excavations and any damage to adjoining areas shall be repaired/restored to existing or better condition to the approval of the Owner, Architect and Engineer.

3.04. WARNING TAPES

A. Direct bury warning tape 12 inches above topmost conduits. For multi-use excavations and trenches, provide multiple tapes. Tapes shall extend into vaults and be stubbed up with and secured to conduits as required for access when tracing or locating.

3.05. LABELING & IDENTIFICATION

A. Junction boxes concealed in ceiling spaces and exposed in electrical, mechanical, utility rooms, and the like shall be marked with the panel and circuit numbers contained within. Marking shall be legibly hand-written with black indelible ink marker.

B. In each junction and pull box, neutral conductors shall be grouped with associated phase conductors by taping the conductors together.
C. Interior spare, C.O., etc. conduits shall be labeled with their destination. Labeling shall be made by neatly hand writing on the conduits or enclosures with indelible marker.

D. Exterior below grade conduits entering electrical rooms, communications rooms, enclosures, vaults, etc. shall be labeled with their destination. Labeling shall be made by neatly hand writing on the conduits or enclosures with indelible marker.

E. Color coding for power cable shall be as follows:

1. 208Y/120 volt, 3 phase, 4 wire:
   Phase A = black, B = red, C = blue, N = white;

2. Equipment ground cables shall be green.

3. Switch legs shall be the same color as the phase conductors. Switch travelers shall be purple.

3.06. BOXES

A. Boxes shall be installed plumb and true and be firmly supported either directly or indirectly by a sound and safe structural member of the building with approved anchors and fasteners, and shall be readily accessible for maintenance.

B. Pull boxes or fittings shall be provided in conduit runs as required to prevent excessive stress on the cables during pulling and to allow the minimum required bending radius.

C. Where an accessible ceiling space exists, locate above the ceiling; otherwise locate in an unobtrusive location to the approval of the Architect, Engineer and Owner.

D. Pull boxes shall be provided at the transition between the surface metal raceway system and conduit or “open” cabling system. Where an accessible ceiling space exists, locate above the ceiling; otherwise locate in an unobtrusive location against the ceiling.

E. Flush mounted switch, outlet, etc. boxes in common non-fire rated walls and facing into different rooms shall be offset a minimum of 6 inches to minimize sound transmission between rooms. Boxes mounted back-to-back will not be allowed. Raceways between boxes in adjoining rooms shall be filled as required to maintain the fire rating (where required) and minimize sound and dust transmission between rooms.

3.07. WIRE AND CABLE

A. All wire and cable shall be enclosed within the raceway system.

B. Inspect cable prior to installation to verify that it is identified properly on the reel or box identification label, that it is of proper gauge, containing correct number of pairs, etc. Note any buckling of the jacket which would indicate possible problems. Damaged cable or any other components failing to meet specification shall not be used in the installation.
C. Conduits of different voltages, systems, functions, etc. shall not be combined in the same raceway or cable unless specifically noted otherwise.

D. Wire and cable shall not be exposed to weather or mechanical damage longer than necessary. Cut ends of the cable shall be immediately sealed to protect from moisture. Duct tape is not an acceptable means of sealing.

E. The contractor shall not receive cable from the supplier if it arrives onsite with the cable ends unsealed.

F. Cable shall be unrolled from reels, or removed from cartons, and installed so as to not damage the insulation or cable sheath and in a manner which will prevent kinking, crushing or excessive tension on conductors and insulation. Use only guides, rollers, sheaves, etc. that are free-turning and clean. Cable shall not be dragged on the ground or over sharp edges or abrasive surfaces. Slack wire shall be provided at all pull points.

G. All cables to be installed in a raceway shall be pulled together. The pulling means (fish tape, cable, rope, etc.) shall be of a type that will not damage the raceway.

H. The minimum bending and sheave radius for pulling 15 kv cable is 21 inches.

I. Telecommunications cables shall be installed without sharp bends (less than 2 inch radius) or pulling tension in excess of 20 pounds.

J. Cable shall be installed or drawn into the raceway system only after all work of any nature that might cause injury to the cable is completed. The raceway system shall be complete, snaked and cleaned before pulling any cable.

K. "Open" telecommunications cables, ancillary systems cables, low voltage control cables, etc. shall be bundled and be supported from permanent structural members of the building, either directly or indirectly, with suitable rings or hooks. Support spacing shall not exceed 5 feet. Cables shall not interfere with the removal of pipes or equipment for maintenance or repair. Support "open" cables a minimum of 6 inches above T-bar ceilings. All "open" cable shall be kept a minimum of 6 inches from pipes, ducts, and other items producing heat. Tape and cable ties are not approved methods of fastening cables.

L. Provide conduits, boxes, etc. for telecommunications and other ancillary systems (where required by the ancillary system provider) "open" cable wiring within walls up to an accessible location above the ceiling.

M. Provide wire/cable markers (Brady type or equivalent/better) identifying its circuit number and/or final destination on all cables/conductors (power, telephone/computer, and other ancillary systems) at panels, devices, junction points, etc.

N. Cable pulling lubricants shall be used to minimize pulling stresses on cable pulled into raceways.
O. Conductor connections shall be made with connectors of the proper size and type. Compression connections shall be made with the correct die and number of crimps, or the correct tightening torque in the case of mechanical connectors, according to manufacturer’s instructions and recommendations. Use suitable oxide inhibiting joint compound on all aluminum terminations. Termination of insulated conductors shall be made so that the stripped length of bare conductor is not longer than required for the terminal or connector. Care shall be taken to not nick conductors during insulation removal.

P. At pulling points, the cables shall be neatly bundled by circuit.

Q. Taps and splices shall be kept to a minimum; and are not allowed in cables larger than #8 AWG, control cable, ancillary systems cable, etc. and below grade without prior approval from the Engineer.

R. Field wiring shall not contact live parts.

S. Cables shall not be supported by their terminations. Suitable cable ties and/or supports shall be utilized in switchboards, panelboards, terminal boxes, junction boxes, vaults, etc. to group and support conductors. All cable shall be fanned-out to terminals and identified by labels; or, if terminated on circuit breakers or control devices, by typewritten indexes or nameplates.

T. Insulated cable supports shall be provided to relieve any strain imposed by cable weight or movement, and to secure cable as required to withstand the effects of fault currents.

3.08. CABLE TESTING

A. Service and feeder cables, including panels with branch circuit breakers open, shall have the insulation resistance to ground measured with other phases grounded after all splices and terminations are made; except, before connection to utilization equipment, fixtures, etc. Test cables phase to phase and phase to ground, with the other phase(s) grounded. Insulation resistance shall be measured using a 500 volt megger, Measure insulation resistance at one minute following the application of the test voltage. The minimum reading shall be 1.0 megohms. Ground each phase at the completion of the test.

B. Branch lighting and general purpose receptacle circuits do not require an insulation test, functional tests only are required; except, all receptacles shall be tested for correct connection using a suitable receptacle tester.

3.09. PENETRATIONS

A. Wall, ceiling and floor penetrations by raceways (both inside and outside the raceway), cables, etc. shall be sealed to maintain the original moisture, dust and fire resistance to the approval of the Architect.

B. Do not cut, notch or drill structural framing members for the installation of raceways without the Architect's approval in each case. Holes and penetrations where allowed in studs, joists and other structural members for raceways and cables shall be of a size to allow for a tight fit.
C. Provide conduit sleeves as required, plus a spare of the same size, where "open" cable passes through floors, walls, partitions, etc.

D. Provide sleeves connecting surface metal raceways on opposite sides of walls.

E. Cut existing surface metal raceway covers on each side of new walls.

F. Floor and ceiling penetrations by "open" cables will not be allowed.

3.10. PULL STRINGS AND ROPES

A. Provide pull ropes in all below grade telecommunications (with and without cables), spare, etc. conduits.

B. Provide pull strings in all above grade telecommunications (with and without cables), spare, etc. conduits.

3.11. ANCILLARY SYSTEMS

A. The Contractor shall coordinate with ancillary systems suppliers and provide conduit, boxes, cables, etc. in accordance with their requirements; except, minimum as indicated and/or specified.

B. Provide a 1 inch EMT conduit from each telecommunications outlet box up to an accessible location above the ceiling.

End of Section 26 05 00
PART 1 - GENERAL

1.01. APPLICABLE PROVISIONS

A. The General, Supplementary and other Conditions of the Contract, modifications to the General Conditions, the Drawings, and the applicable provisions of the other Divisions are hereby made a part of this Division and all its sections.

1.02. SUMMARY

A. The requirements of this Section and the other Division 26, 27 & 28 Sections apply to all the grounding work.

B. Coordinate grounding work with related work shown and specified elsewhere.

C. Provide all materials necessary for the proper execution and completion of the work as herein specified or called for on the drawings. Required items not specifically mentioned in the specifications or indicated on the drawings shall be provided as necessary to produce the intended results.

D. In the event that any item is not available exactly as specified, the Contractor shall so notify the Engineer in writing as early as possible to allow ample time for an alternate item to be selected without delay to the project.

1.03. SUBMITTALS

A. Provide submittals for the following:

1. Ground rods.
2. Test method and equipment for system testing.

PART 2 - PRODUCTS

2.01. GROUNDING

A. Ground rods shall be copper clad steel, \( \frac{5}{8} \) inch diameter by 10 feet long minimum.

B. Ground clamps, nuts, washers, etc. shall be corrosion resistant high copper alloy or silicon bronze; except, below grade and foundation rebar ground connections shall be exothermic welded (Cadweld or approved equal) or copper compression type.

C. Ground clamps, nuts, washers, etc. shall be corrosion resistant high copper alloy or silicon bronze; except, below grade ground connections and connections within the Sewer Pump Station wet and dry wells shall be exothermic welded (Cadweld or approved equal) or copper compression type.
D. Ground terminals in power vaults shall be a #2/0 AWG bare copper cable around the entire perimeter of the vault. Support as required. Tap connections to multi-grounded neutral and/or ground cables shall be with copper compression type C-taps.

E. Feeder circuits, branch circuits, control circuits, etc. shall include a separate equipment ground cable (sized the same as the largest circuit conductor, unless otherwise noted) run in the same raceway with the circuit conductors or bundled with the circuit conductors if run “open”. Equipment ground conductors for feeder (high voltage and low voltage) circuits, branch circuits, control circuits, etc. installed in metallic raceways shall be redundant, consisting of both an electrically continuous metal raceway system and the separate equipment ground cable run in the same raceway with the circuit conductors.

2.02. SWITCHBOARDS AND PANELS

A. Provide both ground and neutral bars in switchboards and panels (new and existing). All connectors and lugs shall be solderless, pressure type suitable for copper or aluminum wire.

2.03. WIRE AND CABLE

A. Ground wire and cable sizes indicated and/or specified are minimums only and shall be increased as required due to NEC, system, load, voltage drop, etc. requirements.

B. Ground electrode conductors shall be copper, bare below grade.

C. Equipment ground cable shall be single conductor stranded copper with 600 volt type XHHW or THWN/THHN insulation. Conductor size shall match feeder, branch circuit, etc. conductor size unless noted otherwise.

D. Telecommunications ground cable shall be single conductor stranded copper with 600 volt type XHHW or THWN/THHN insulation. Conductor size shall be minimum #6 AWG unless noted otherwise. Conductor insulation for #2 AWG and smaller cables shall be green color; insulation for #1 and larger cables may be black with green marking tape applied in telecommunications rooms.

E. Cable lugs at ground bars, equipment, racks, etc. shall two-hole bolt-on compression type, long barrel, 5/8 inch hole spacing for #6 AWG and smaller cables, 1 inch hole spacing for #4 AWG through #1/0 AWG cable and 1 3/4 inch hole spacing for #2/0 AWG and larger cable. Mounting bolts shall be 1/4 inch, 3/8 inch or 1/2 inch diameter (as required), with hex head bolts, beveled or spring type washers, lock washers and hex head nuts; Thomas & Betts 548 series or Burndy YA series (no exceptions).
PART 3 - EXECUTION

3.01. GROUNDING

A. All electrical equipment, enclosures, boxes, devices, etc. shall be provided with a ground fault return path by means of an insulated grounding conductor installed with the circuit conductors, and the integrity of the raceway system if applicable. Bond raceway system as required.

B. Ground terminals of all equipment, devices, etc. shall be grounded by the equipment ground conductor.

C. Raceways shall be closely and tightly fitted in couplings, connectors, boxes, etc. to provide an electrically continuous low resistance ground fault return path. Threaded joints shall be made up with at least 5 threads fully engaged.

D. Building steel and interior metal piping systems shall be suitably bonded.

E. Each service shall be grounded to the driven ground rods.

F. Each service shall be grounded to the concrete encased grounding electrode (foundation rebar). Contractor shall verify that the foundation concrete is in direct contact with earth and is not insulated from contact by a vapor barrier or by moisture sealant paint. Where the concrete reinforcing bars are not suitable for use as a grounding electrode, Contractor shall provide minimum 20 feet of # 4 AWG ground cable encased in the concrete.

G. Telecommunications main ground bar shall be bonded to the electrical service ground point, water piping and building steel with a minimum # 2 AWG ground cable or larger where indicated.

H. Exothermic welded connections shall be done strictly in accordance with manufacturer's instructions, and then enclosed in an air-tight sealing compound to prevent moisture intrusion and minimize corrosion. Molds shall not be altered. All connection materials shall be of the same manufacturer.

I. Compression connections shall be made with the correct die and number of crimps, or the correct tightening torque in the case of mechanical connectors, according to manufacturer's instructions and recommendations.

J. Grounding conductors exposed to mechanical damage shall be protected with PVC conduit sleeves with bushings.

K. Before grounding connections are made, contact surfaces shall be thoroughly cleaned and anti-oxidant solution applied.

L. Connections shall be both mechanically and electrically secure. Torque connecting hardware in accordance with the manufacturer's instructions and recommendations.

M. Torque connecting bolts at telecommunications grounding busbars to 35 ft/lbs.
N. Tests shall be made to verify the continuity of the ground system and all ground fault return paths.

O. After completion of the grounding system, the resistance of the grounding network to earth shall be measured using a ground megger using a fall of potential test method. Driven ground rods shall be disconnected and tested separately from the grounding system. The minimum ground earth resistance shall be maximum 25 ohms.

End of Section 26 05 26
PART 1 – GENERAL

1.01. APPLICABLE PROVISIONS

A. The General, Supplementary and other Conditions of the Contract, modifications to the General Conditions, the Drawings, and the applicable provisions of the other Divisions are hereby made a part of this Division and all its sections.

1.02. SUMMARY

A. The requirements of this Section and the other Division 26, 27 & 28 Sections apply to all the thermal & moisture protection work.

B. Coordinate thermal & moisture protection work with related work shown and specified elsewhere.

C. Provide all materials necessary for the proper execution and completion of the Work as herein specified or called for on the drawings. Required items not specifically mentioned in the specifications or indicated on the drawings shall be provided as necessary to produce the intended results.

D. In the event that any item is not available exactly as specified, the Contractor shall so notify the Engineer in writing as early as possible to allow ample time for an alternate item to be selected without delay to the project.

1.03. SUBMITTALS

A. Provide submittals for all moisture, fire and dust stop materials, complete with a description of where each type is proposed to be used.

PART 2 - PRODUCTS

2.01. GENERAL

A. Coordinate the features of materials and equipment so they form an integrated system.

2.02. MOISTURE PROOFING

A. Moisture proofing systems shall be designed and installed to allow the passage of cable, conduit or pipe through exterior walls, etc. and vaults. They shall provide a barrier seal to prevent the penetration of water and gases into the structure to be penetrated.
2.03. DUST SEALING MATERIALS

A. Dust seal systems shall be designed and installed to allow the passage of cable, conduit or pipe through non-rated ceilings, walls, partitions or floors.

B. Dust sealant around raceways and the like shall be top grade paintable silicone based or poly-sulfite caulk, or expanding foam type sealant.

C. Dust sealant around cable penetrations, within raceways, etc. shall allow removal of the material for future cable additions and/or removals.

PART 3 - EXECUTION

3.01. MOISTURE PROOFING

A. Conduit terminations at equipment, etc. shall be suitably sealed and/or plugged at both ends to prevent the entrance of moisture.

B. Underground conduits extending into buildings and at transformers, switchgear, etc. shall be suitably sealed or plugged at both ends. Underground conduits between vaults shall be suitably sealed or plugged at the high end. Sealant shall be removable. Ductseal is not acceptable.

C. Conduit penetrations through retaining walls and building exterior walls shall be suitably sealed and/or grouted to prevent the entrance of moisture.

D. PVC conduit shall be solvent welded to prevent the entrance of moisture.

E. Vault lids, conduit and cable entrances, etc. shall be suitably sealed and/or grouted to prevent the entrance of moisture.

F. Vaults shall be drained from at, or near, its bottom to the nearest point in a storm drain or drainage ditch below the level of the vault base. Provide suitable rodent screen on the end of each drain.

G. Comply with manufacturer's installation instructions and recommendations particular to each product for all roof penetrations. Repair existing roofing and flashing altered by work, including restoration of base, insulation, membranes, flashing, adhesives, sealants, and roofing accessories integrally related to roof installations. Clean all effected surfaces prior to roofing work.

End of Section 26 07 00
PART 1 - GENERAL

1.01. APPLICABLE PROVISIONS

A. The General, Supplementary and other Conditions of the Contract, modifications to the General Conditions, the Drawings, and the applicable provisions of the other Divisions are hereby made a part of this Division and all its sections.

1.02. SUMMARY

A. The requirements of this Section and the other Division 26, 27 & 28 Sections apply to all the electrical work.

B. Coordinate electrical work with related work shown and specified elsewhere.

C. Provide all materials necessary for the proper execution and completion of the work as herein specified or called for on the drawings. Required items not specifically mentioned in the specifications or indicated on the drawings shall be provided as necessary to produce the intended results.

D. In the event that any item is not available exactly as specified, the Contractor shall so notify the Engineer in writing as early as possible to allow ample time for an alternate item to be selected without delay to the project.

1.03. SUBMITTALS

A. Provide submittals for the following:

1. Panelboards.
2. Circuit breakers.
4. Disconnect switches.
5. Fuses.

PART 2 - PRODUCTS

2.01. ELECTRICAL STUDIES

A. Gear supplier shall provide arc flash study and warning nameplates on all switchgear, switchboards, panelboards, etc. to warn personnel of potential arc flash and shock hazards in compliance with the NFPA 70E standard. Nameplates shall include the voltage system, arc flash boundary limits and PPE category specific to the location.
2.02. **ANCILLARY SERVICES**

A. Telephone terminal board shall be $3/4$ inch fire treated plywood, size as required; except minimum 4' wide x 8' high. Finish paint with durable white enamel prior to installation of equipment, blocks, racks, etc.

B. Cable television terminal box(es) shall be in accordance with the requirements of Comcast.

C. Telephone, cable television and fiber optic service and feeder conduits shall have suitable pull wires or ropes, to the approval of the respective utilities.

2.03. **PANELS**

A. Panels shall be dead-front, circuit breaker type panelboards, suitable for use as service entrance equipment where required. Branch circuits shall be arranged using double row construction. Interiors shall be rigid and so designed that circuit breakers can be replaced, changed or added without disturbing adjacent units and without machining, drilling, or tapping.

B. Busses shall be copper or tinned aluminum. Ground and neutral bars shall be provided. All connectors and lugs shall be solderless, pressure type suitable for copper or aluminum wire.

C. Panels shall all be of the same manufacturer, Eaton, General Electric, Siemens, or Square D, no substitutions.

D. Circuit breakers shall be bolt-on in panelboards, molded-case, thermal magnetic, quick make-quick break type with trip indicating handles. Branch circuit breakers for motor loads shall be HACR type. Branch circuit breakers for lighting loads shall be SWD type. Multi-pole breakers shall be single-handle, internal common trip. Tandem breakers shall not be used.

E. Provide padlocking devices on circuit breakers where required.

F. Provide approved handle ties between single pole circuit breakers for all multiwire branch circuits as required.

G. Main and/or feeder breakers and branch circuit panels and breakers shall be series short circuit rated.

H. Supplier shall provide a coordination study to select proper trip settings for all main and feeder circuit breakers.

I. Circuit breakers for installation in the existing panelboard(s) shall be of the same manufacturer, and be of a type manufactured specifically for that type, vintage and short circuit rating of the panelboard.

J. Ground fault protection systems shall include current sensors and all necessary relaying and tripping components. The current sensor shall enclose all phase and neutral conductors. Ground fault relays shall be of solid state design with adjustable pickup and time delay settings, be selectively coordinated between the main and feeder relays, and shall include test provisions.
K. Spaces shall be bussed for the maximum device that can be fitted into them, and shall be equipped with mounting and connecting accessories for future installation of circuit breakers.

L. Panels shall be suitable for top and bottom entry of feeder and branch circuit conduits, cables, etc.

M. Panels shall be industrial/commercial type panelboards with hinged “door-in-door” covers, catch and lock (all keyed alike). Residential type loadcenters will not be allowed.

N. Panels and each feeder breaker in each (clearly and accurately identifying the function and location) shall have laminated plastic master nameplates. The panelboard nameplate shall include the name of the panel and the name and location of the equipment from which the power originates.

O. Panels shall be provided with laminated plastic nameplates to identify the system color coding scheme for phase and neutral conductors as required.

P. Panels shall be provided with warning nameplates to warn personnel of potential arc flash and shock hazards in compliance with the NFPA 70E standard. Nameplates shall include the voltage system, arc flash boundary limits and PPE category specific to the location.

Q. Panels shall have a circuit directory frame and card with a transparent cover furnished on the door. Directory cards shall have a typewritten index clearly and accurately identifying the function and location (using the room name and numbering system shown on the Architectural plans) of the circuit. Provide new typewritten circuit directory cards for all existing panels that are modified in any way.

R. Circuit directory cards shall be arranged to match the physical arrangement of the breakers, with odd numbered circuits on the left side of the card and even numbered circuits on the right side of the card. Where required due to the size of the directory frame, the odd numbered circuits may be on a separate card from the even numbered circuits. Odd and even numbered circuits shall not be intermingled together.

2.04. SURGE ARRESTORS

A. Surge arrestors shall be a heavy-duty secondary surge protective devices, UL 1449, third edition listed. Surge arrestors shall be bi-polar and bi-directional, providing all mode protection (L-L, L-N, L-G and N-G) and EMI/RFI filtering. Surge arrestors shall be Category C suitable for service entrance protection at the main service switchboard and Category C for panelboard protection at the downstream panels. The suppression system shall incorporate metal-oxide varistors (MOVs) as the core surge suppression component. Each unit shall include a high-performance EMI/RFI noise rejection filter. All components and diagnostics shall be contained within one discrete assembly. Enclosures shall be weatherproof, with hinged cover and status indication.

1. Surge arrestors shall be rated for minimum 80,000 amps total surge current capacity per phase and 40,000 amps per mode.
B. Surge arrestors shall be Protector Series manufactured by Innovative Technology, ServiceTrack ST series by Total Protection Solutions, with a 20 year warranty minimum, or approved equal.

2.05. DISCONNECT SWITCHES

A. Disconnect switches shall be heavy-duty, horsepower rated, safety switches, suitable for use as service entrance equipment where required. The switches shall have a handle whose position is easily recognizable, lockable in the OFF position, operable from the front and in control of the disconnecting means with the cover open or closed. The switch position shall be non-teasible, positive, quick make-quick break. Line, load, neutral and ground lugs shall be provided as required. Cable terminals shall be suitable for copper and aluminum wire.

B. Disconnect switches shall be identified with laminated nameplates, black face, white core, engraved with minimum 1/4 inch letters describing its function. The disconnect nameplate shall include the name of the disconnect and the name and location (where not immediately obvious from its location) of the equipment from which the power originates.

C. Disconnect switches shall be provided with warning nameplates to warn personnel of potential arc flash and shock hazards in compliance with the NFPA 70E standard. Nameplates shall include the voltage system, arc flash boundary limits and PPE category specific to the location.

2.06. FUSES

A. Fuses shall be dual-element, current limiting, rejection type, Class RK-5.

B. Fuses shall be dual-element, current limiting, rejection type, Class RK-5; except, fuses in the handhole at each light pole shall be Class CC.

2.07. WIRING DEVICES

A. Wiring devices shall be specification grade, all of the same manufacturer, white colored.

B. Lighting switches shall be toggle, AC quiet type rated 20 amps, 120-277 volt. Pilot light switches shall be lit when on. Key switches shall be lock type with black nylon key guide and 1 key per switch.

C. Refer to Section 26 50 00 Lighting for occupancy sensing wall switches and low voltage lighting control switches.

D. Equipment disconnect type switches shall be toggle, heavy duty manual motor controllers, horsepower rated, with the number of poles and ampere rating indicated and/or required.

E. General purpose receptacles shall be 15 amp, 125 volt, AC, straight blade, 3-wire grounding type.
F. Controlled receptacles shall be same as general purpose receptacles, except shall be gray color and shall be permanently engraved with the controlled receptacle icon on the face of the device.

G. Ground fault interrupter (GFI) type receptacles shall be duplex, Class A, 15 amp, 125 volt with end of life protection (either by rendering itself incapable of delivery power or by visual indication) and reverse line-load miswire protection. Provide individual ground fault interrupter type receptacles at each location indicated or as required. Feed-through type protection of multiple outlets will not be allowed.

H. Flush mounted devices shall have smooth specification grade stainless steel wallplates.

I. Surface mounted devices shall have raised surface type covers, galvanized steel.

J. Weather-proof devices (other than receptacles) shall be equipped with stainless steel or cast metal covers and spring-loaded gasketed doors.

K. Weather-proof receptacles shall be equipped with heavy duty die cast while-in-use covers. Covers shall maintain a weatherproof rating whether or not an attachment plug is inserted. Intermatic WP3110MXD series, or approved equal.

L. All outlets shall be labeled with the panel and circuit number(s) from which the device is fed. Labels shall be heavy duty adhesive type, clear with black letters on light colored devices and clear with white letters on dark colored devices. Lettering shall be appropriately sized for the application, except minimum 1/4 inch. Labels on ceiling mounted devices shall be large enough to read from the floor. Labels shall be as manufactured by Kroy, Brothers, or approved equal. Self-adhesive circuit numbers, masking tape, plastic punch type "Dymo" labels, etc. are not acceptable.

2.08. EQUIPMENT IDENTIFICATION

A. Provide nameplates for all equipment and other devices used for the control of circuits, equipment, etc. Include the panel and circuit number(s) from which it is fed.

1. Panelboards and each feeder circuit breaker within each.

2. Motor starters, contactors, etc.

3. Disconnect switches.

B. All distribution equipment (switchboard, panelboards, motor control centers, etc.) shall be provided with laminated plastic nameplates to identify the system color coding scheme for phase and neutral conductors as required.

C. All distribution equipment (switchboard, panelboards, motor control centers, etc.) shall be provided with warning nameplates to warn personnel of potential arc flash and shock hazards in compliance with the NFPA 70E standard. Nameplates shall include the voltage system, arc flash boundary limits and PPE category specific to the location.
D. Definite purpose devices shall be labeled with a description of the device's function, rating and include the panel and circuit number(s) from which it is fed.

E. All equipment and outlets shall be labeled with the panel and circuit number(s) from which it is fed.

F. Labels shall be heavy duty adhesive type, clear with black letters on light colored devices and clear with white letters on dark colored devices. Lettering shall be appropriately sized for the application, except minimum $\frac{1}{8}$ inch. Labels on ceiling mounted devices shall be large enough to read from the floor. Labels shall be as manufactured by Kroy, Brothers, or approved equal. Self-adhesive circuit numbers, masking tape, plastic punch type "Dymo" labels, etc. are not acceptable.

G. Nameplates shall adequately describe the function or operation of the identified equipment, devices, etc. and, where applicable, include the panel and circuit number(s) from which it is fed. Nameplate designations shall be consistent with the project documents. Submit proposed inscriptions for approval.

PART 3 - EXECUTION

3.01. TEMPORARY POWER

A. The Contractor shall provide all temporary power services, facilities, equipment, devices, material, etc. required for the construction; including adequate lighting, outlets, balancing, testing, etc. as may be necessary for the proper performance and inspection of the work.

B. During power interruptions, and if Contractor's equipment will not operate on the available power, the contractor shall supply all equipment needed, such as transformer(s), generator(s), etc. and pay all costs involved.

C. The temporary power system shall be provided in a neat and safe manner, in compliance with governing codes and good working practice.

D. Permanent receptacles which are used for temporary power during construction shall be replaced with new devices at the completion of construction.

E. The temporary power system shall be removed when no longer required.

3.02. LOCATIONS

A. The mounting heights and location of similar equipment and devices shall be consistent, in accordance with the requirements of the ADA where applicable. Special purpose items shall be located conveniently for the purpose intended.
B. Devices shall be located to not interfere with the removal of pipes or equipment for maintenance or repair. All devices shall be kept a minimum of 6 inches away from items producing heat.

C. Disconnect switches, circuit breakers, etc. shall, in no case, be installed so that the grip of the operating handle, when in its highest position, is more than $6\frac{1}{2}$ feet above the floor or working platform.

D. Outlets (power, telecommunications, etc.) shall be mounted 18 inches to centerline above finished floor unless noted otherwise; except, outlets above counters, etc. shall be mounted 6 inches to centerline above the counter or 3 inches to centerline above the splashboard, whichever is higher.

E. Locate light switches, etc. 6 inches from door casings (except on center in spaces less than 12 inches), 42 inches to centerline above finished floor. Where light switches are adjacent to countertops, install the switches at the same height as adjacent devices above the countertop.

F. Prior to rough-in, the Contractor shall mark or otherwise show the location of all equipment and devices, and obtain specific approval from the Owner and Architect for the location of each prior to installing enclosures, boxes, raceways, etc.

3.03. EQUIPMENT AND DEVICES

A. Equipment, devices, enclosures, etc. shall be installed plumb and true and shall be square with the adjacent walls, ceilings and structural members.

B. Equipment, cabinets, boxes, etc. shall be accurately mounted and leveled and be firmly supported either directly or indirectly by a sound and safe structural member of the building in accordance with manufacturer's instructions, or as directed. Supports shall be neatly placed and properly fastened.

C. The correct lifting, jacking and/or moving gear which will prevent damage to the equipment shall be used.

D. Bolts, nuts, screws and other fastenings shall be tightened and all covers replaced on equipment and boxes. Electrical connections, particularly those on bus work in panelboards, etc. shall be checked to ensure tightness and electrical conductivity. Gaskets, seals, etc. shall be checked for proper fit.

E. Follow manufacturer's installation details wherever available. Provide boxes, mountings, wiring or fittings required, standard or special.

F. The Contractor shall touch-up paint all scratched, marred or damaged factory finish on equipment, devices, enclosures, etc.
3.04. DEVICES

A. Flush mounted switch, outlet, etc. boxes in common non-fire rated walls and facing into different rooms shall be offset a minimum of 6 inches to minimize sound transmission between rooms. Flush mounted switch, outlet, etc. boxes in common rated fire resistive walls and facing into different rooms shall be offset a minimum of 24 inches. Boxes mounted back-to-back will not be allowed. Raceways between boxes in adjoining rooms shall be filled as required to maintain the fire rating (where required) and minimize sound and dust transmission between rooms.

3.05. TESTING

A. Before testing, visually inspect equipment thoroughly, and perform mechanical operation and key interlock tests in accordance with manufacturer’s instructions.

B. Before energization, test all equipment in accordance with manufacturer’s recommendations; except minimum as described below.

C. Insulation Resistance Tests:
   1. Test using a 500 VDC or 1000 VDC megohmmeter.
   2. Ground all phases not being tested.
   3. Measure insulation resistance at one minute following the application of the test voltage.
   4. Ground each phase at the completion of the test.

D. Compare test results with factory-obtained results and results on similar equipment. Investigate variations. Consult manufacturer for recommendations.

E. Upon completion, all equipment and systems shall be tested for functional operation, including all intended modes and sequences of operation.

F. Record the values of each test, along with the description of the instrument, voltage level, temperature, time, and date of the test on the form included in the contract documents. Sign the results.

End of Section 26 20 00
PART 1 - GENERAL

1.01. APPLICABLE PROVISIONS

A. The General, Supplementary and other Conditions of the Contract, modifications to the General Conditions, the Drawings, and the applicable provisions of the other Divisions are hereby made a part of this Division and all its sections.

1.02. SUMMARY

A. The requirements of this Section and the other Division 26, 27 & 28 Sections apply to all the lighting and lighting control work.

B. Coordinate lighting and lighting control work with related work shown and specified elsewhere.

C. Provide all materials necessary for the proper execution and completion of the work as herein specified or called for on the drawings. Required items not specifically mentioned in the specifications or indicated on the drawings shall be provided as necessary to produce the intended results.

D. Lighting control system work shall include all necessary set-up, programming, testing, commissioning, etc. for a complete and operational system, adjusted, tested and ready for operation.

E. In the event that any item is not available exactly as specified, the Contractor shall so notify the Engineer in writing as early as possible to allow ample time for an alternate item to be selected without delay to the project.

1.03. QUALITY ASSURANCE

A. The lighting systems and all controls shall be in accordance with the Washington State Energy Code (WSEC), ASHRAE 90.1 as well as LEED certification requirements.

1.04. SUBMITTALS

A. Provide submittals for the following:

1. Lighting fixtures, poles and lamps.
2. Pre-cast pole bases.
3. Contactors, relays, contactor panels, control panels, etc.
4. Low voltage lighting control system and components.
5. Street light junction boxes.

B. Provide complete manufacturer's schematic drawings for each system.
PART 2 - PRODUCTS

2.01. GENERAL

A. Fixtures, luminaires, poles, etc. shall include all necessary mounting and connecting accessories.

B. Contractor & lighting fixture supplier shall verify that the fixture description match the catalog numbers on the Lighting Fixture Schedule, and that mounting requirements are correct. Advise Engineer of any conflicts or discrepancies.

2.02. LIGHTING

A. Light Emitting Diode (LED) luminaires shall have a luminous efficacy of at least 100 lumens/W, a color temperature of 3500 K, a CRI of at least 80, an estimated life of at least 70,000 hours at 70% lumen maintenance, and shall include a minimum 5-year warranty on the entire luminaire including the driver. The luminaire and LEDs shall have been tested in accordance with LM-79 and LM-80.

B. Light Emitting Diode (LED) street lighting fixtures shall be cast aluminum housing, powder coat finish, suitable for -40F to 122F temperature range and shall be IP66 rated. Fixture shall include a heat sink housing, metal core printed circuit board and surge protector (10kV). Fixture shall have a correlated color temperature of 4000K and a CRI of 100. Average rated life shall be 70,000 hours.

2.03. EMERGENCY LIGHTING POWER UNITS

A. Emergency lighting power units shall provide automatic standby power for the operation of lighting fixtures automatically upon interruption of normal electric power for a minimum of 90 minutes.

B. Each emergency lighting power unit shall be a single unit complete with inverter module, battery charger, batteries and all other required electrical and mechanical equipment, devices, etc.; UL 924 listed (Emergency Lighting and Power Equipment).

2.04. LIGHT POLES

A. Light poles shall be base mounted, straight square extruded aluminum with a hollow core, handhole with baseplate, galvanized anchor bolts and luminaire mounting accessories as required. Corners shall be radiused. Pole shall be natural anodized to match luminaire. The poles shall be designed with the luminaire loadings required and in accordance with the 50 year mean recurrent interval wind (except minimum 100 miles per hour) and ice loading, height coefficients, shape coefficients and factors of safety specified by the American Association of State Highway and Transportation Officials.
B. Pole Bases shall be poured-in-place or precast concrete, of the size and shape as recommended by the pole manufacturer for the soil conditions at the site (except minimum as indicated). Concrete shall conform to the Standard Specifications.

C. Anchor bolts shall be L-type, of the size as recommended by the pole manufacturer. Anchor bolts shall be hot dipped galvanized after fabrication.

2.05 LIGHTING CONTROLS

A. Occupancy sensors and photosensors shall be by the same manufacturer and shall form a single integrated system in each room.

B. Occupancy sensors:

1. Occupancy sensors shall be combination passive infrared and ultrasonic type, ceiling mounted, with adjustable time delay, adjustable sensitivity, and an LED indicator. Lenses shall be as required for the application (e.g. wide angle for open areas and the like and long range for corridors). The sensors shall be able to detect the difference between a human body and the background space. Occupancy sensors shall be Greengate OAC-DT-2000-R, Lutron LOS-CDT-2000, or approved equal.

2. Relays/power packs for use with low voltage switching shall be remote mounted, 120 or 277 volt AC input (as required), 24 volt DC output, with single or multiple relays and contacts rated minimum 20 amps as required. Relays/p power packs shall be capable of controlling and/or being controlled by up to minimum 3 sensors and shall be capable of selection between automatic on mode and manual on mode. Power packs shall be capable of being connected to a momentary contact switch for manual switching of connected loads. Occupancy sensors relays/power packs shall be of the same manufacturer and specifically designed for use with the occupancy sensors, Greengate SP20-RD4, Lutron PP-DV, or approved equal.

3. Where required due to the quantity of occupancy sensors, provide additional remote power supplies. Power supplies shall be of the same manufacturer and specifically designed for use with the occupancy sensors.

C. Low voltage wall switches shall be of the same manufacturer and specifically designed for use with the low voltage sensors and relay/power packs.

1. Wall switches for on-off applications (manual-on applications) shall be momentary contact type, shall have similar appearance as adjacent line voltage toggle type switches, shall be Leviton 1081, Greengate GMT, Hubbell HBL1556, Lutron NT-DPDT-CO-MO, Pass & Seymour 1250, or approved equal.

2. Wall switches for 0-10 volt dimming applications shall be Lutron NTSTV-DV, Luxdrive F019, or approved equal.

3. Color and faceplates shall match other wall devices, switches, and outlets as specified.
D. Lighting level photosensor controls shall be photodiode type, adjustable, capable of dimming lighting in response to varying light levels sensed in the daylight zone, produce a 0-10V dimming control signal for direct connection to associated fixtures. Sensors shall be Hubbell DLC7, or approved equal.

E. Motion sensor switches shall be ultrasonic or passive infrared type, wall mounted, color to match the devices in the building, 120-277 volt, rated minimum 1200 watt, with built-in light level sensor, adjustable sensitivity, adjustable time delay, switch (2 switches if dual control) for manual control and vandal resistant hard lens. Buttons on the face of the switches shall operate in toggle mode to manually turn on/off connected lighting loads. Motion sensor switches shall be Hubbell type LHMTS1, Square D type PIR, Sensor Switch type WSX-PDT, or Greengate ONW-D-1001-MV for single switch/level applications and Watt-Stopper type PW-200, Hubbell type LHMTD2, Square D type PIR or Sensor Switch type WSX 2P-PDT for dual level/switch applications, or approved equal.

F. Timer switch shall be 7 day, digital programmable type, 1 channel, capable of minimum 20 setpoints within a 7 day period plus 1 astro on and 1 astro off setpoint per day. Timer shall have LCD digital readout and manual on/off buttons on the face. Timer shall be Intermatic model EI600, or approved equal.

G. Time clocks shall be capable of retaining programming and the time setting during loss of power for a period of 10 hours, minimum. (per NREC 2012)

2.06. LIGHTING CONTACTORS, RELAYS AND CONTROL DEVICES

A. Control relays shall be 20 amp rated, DPST, electrically operated, with LED indicating light, 120V coil and coil side override switch. Relays shall be Functional Devices, Inc. RIB relay.

2.07. WIRE AND CABLE

A. Fixture whips provided as an assembly by the fixture manufacturer with the fixtures shall be #14 AWG.

B. Fixture cable, where supplied by the Contractor, shall be stranded copper with 600 volt type PF insulation.

C. Lighting control system cable shall be as required by the lighting control system manufacturer. Cable shall be listed as being resistant to the spread of fire and bear flammability testing ratings as communications cable type CM or control cable type CL2; except in air handling plenums, cable shall be plenum rated, be listed as being resistant to the spread of fire and bear flammability testing ratings as cable types CMP or CL2P respectively.

2.08. SITE LIGHT HANDHOLES

A. Handholes shall be precast concrete, open bottom, in accordance with the Washington State Department of Transportation type J-11A, type 1; except, boxes may be nonmetallic type in...
landscaped areas where there will not be any vehicle traffic, foot traffic, lawn mowers, etc. (e.g. flower beds and the like). Covers shall be diamond plated galvanized steel on concrete boxes and nonmetallic on nonmetallic boxes, with the lettering "Site Lighting" permanently installed.

B. Waterproof 600 volt fused rejection/quickdisconnect type kits with Class CC fuses shall be installed in the handhole at each light pole.

2.09. NAMEPLATES AND LABELS

A. Provide nameplates for all lighting switches in classrooms as indicated on the drawings.

B. Provide label cards for lighting timeclock to identify the panel and circuit number and the load served by each channel.

C. Provide label cards for the lighting control panel to identify the panel and circuit number and the load service by each relay.

D. Nameplates shall adequately describe the function or operation of the identified equipment, devices, etc. Nameplate designations shall be consistent with the project documents. Submit a sample of nameplates for approval.

PART 3 - EXECUTION

3.01. LOCATIONS

A. The mounting heights and location of similar equipment and devices shall be consistent, in accordance with the requirements of the ADA where applicable. Special purpose items shall be located conveniently for the purpose intended.

B. Disconnect switches, circuit breakers, etc. shall, in no case, be installed so that the grip of the operating handle, when in its highest position, is more than 6\(\frac{1}{2}\) feet above the floor or working platform.

C. Prior to rough-in, the Contractor shall mark or otherwise show the location of all equipment and devices locations, and obtain specific approval from the Owner and Architect for the location of each prior to installing enclosures, boxes, raceways, etc.

D. Outlets shall be mounted 18 inches to centerline above finished floor unless noted otherwise.

E. Locate light switches, lighting control stations, etc. 6 inches from door frames (except on center in spaces less than 12 inches), 42 inches to centerline above finished floor. Where located at the hinge side of a door, locate 6 inches beyond the end of the door swing. Match the height of existing similar devices in the immediate vicinity.
3.02. EQUIPMENT, LUMINAIRES AND DEVICES

A. Equipment, luminaires, devices, etc. shall be installed plumb and true and shall be square with the adjacent walls, ceilings and structural members.

B. Unless noted or indicated otherwise, orientation of luminaires within a space shall be consistent.

C. Recessed luminaires:
   1. Maintain code and manufacturer required clearances from combustible materials around luminaires.
   2. Maintain code and manufacturer required clearances from insulation around luminaires.
   3. Recessed luminaires in rated ceilings shall be enclosed or otherwise provided with an approved pre-manufactured fire rated barrier as required to ensure the integrity of the fire rated assembly. Maintain code and manufacturer required clearances around luminaires.
   4. Coordinate with general and insulation contractors, ceiling provider, etc.

D. Lighting poles and associated luminaires shall be set to stand plumb and true and shall be square with the adjacent buildings, property lines, sidewalks, roadway, etc.

E. Occupancy sensors shall be mounted and aimed in accordance with manufacturer's recommendations. All necessary adjustments and settings shall be made in order to ensure the lights will operate when the room is occupied.

F. Photoelectric controls shall be mounted and aimed in accordance with manufacturer's recommendations. All necessary adjustments and settings shall be made in order to ensure the controls will operate properly.

G. The correct lifting, jacking and/or moving gear which will prevent damage to the equipment shall be used.

H. All bolts, nuts, screws and other fastenings shall be tightened and all covers replaced on equipment and boxes. All electrical connections shall be checked to ensure tightness and electrical conductivity. All gaskets, seals, etc. shall be checked for proper fit.

I. Follow manufacturer's installation details wherever available. Provide any special mountings, wiring or fittings required.

J. Provide complete manufacturer's schematic drawings for each system. Any deviations between schematic drawings and contract documents shall be outlined in a separate cover letter. Said deviations will be subject to approval by the Engineer.

K. Provide gaskets, seals, etc. as required to prevent the entrance of moisture, debris, insects, etc. Check for proper fit.
L. Repair damaged corrosion protection and touch-up paint all scratched, marred or damaged factory finish on equipment, devices, fixtures, enclosures, etc.

3.03. SUPPORTS

A. Provide all necessary supports and backing for all fixtures, boxes, enclosures, etc. Attach to wood with wood or lag screws, to metal with machine screws or bolts and to concrete with carbon steel wedge or sleeve type expansion anchors or self-drilling metal anchors and machine screws or bolts. Use size and number of attachments as required to support equipment, fixtures, etc. weight with a safety factor of at least four.

B. Powder actuated fasteners, plastic expansion type anchors, nails and toggle bolts are not permitted.

C. Brace all equipment, etc. as required to meet the requirements of seismic zone 3.

D. Fixtures, luminaires, etc. shall be accurately mounted and leveled and be firmly supported either directly or indirectly by a sound and safe structural member of the building in accordance with manufacturer's instructions, or as directed. Supports shall be neatly placed and properly fastened.

E. Forms shall not be used while placing light standard (pole) bases. Concrete shall bear against undisturbed earth.

F. Lighting poles shall be set to stand perpendicular on bases and in exact alignment, unless specifically noted otherwise. Bases shall be grouted to cover leveling nuts and to fill the void under the base plate with non-shrinking grout.

G. Follow manufacturer's installation details wherever available. Provide all supports, mountings, etc. required, standard or special.

3.04. HANDHOLES

A. Handholes shall be installed plumb and true and shall be square with the adjacent buildings, property lines, sidewalks and roadway, with top flush with grade.

B. Handholes shall be set in the sidewalk, immediately behind the curb, with top flush with sidewalk.

C. Handholes bedding material shall consist of a minimum of 3 to 6 inches compacted sand or gravel, graded level.

D. Junction box lids, conduit and cable entrances, etc. shall be suitably sealed and/or grouted to prevent the entrance of moisture.

E. Prior to excavation, the Contractor shall mark or otherwise show the location of all equipment and vaults, and obtain specific approval from the Owner and Engineer for the location of each prior to installing equipment, boxes, raceways, etc.
3.05. WIRES AND CABLES

A. Inspect cable prior to installation to verify that it is identified properly on the reel or box identification label and that it is of proper gauge, containing correct number of pairs, etc. Note any buckling of the jacket which would indicate possible problems. Damaged cable or any other components failing to meet specification shall not be used in the installation.

B. Line voltage cable within poles shall be routed in electrical nonmetallic tubing as required to maintain separation of line and low voltage cabling.

C. All exposed cable shall be run in the raceway system, except where specifically approved otherwise. “Open” wiring will not be allowed.

D. All concealed power limited systems cable may be run “open” in accessible ceilings; except, where indicated otherwise and where penetrating through ceilings, floors, walls, draft-stops, etc.

E. "Open" cables shall be bundled and supported from permanent structural members of the building, either directly or indirectly, with suitable hooks. Support spacing shall not exceed 5 feet. Protect “open” cables during installation in ceiling spaces. Cables shall not interfere with the removal of pipes or equipment for maintenance or repair. All "open" cable shall be kept a minimum of 6 inches from pipes, ducts, and other items producing heat. Support "open" cables a minimum of 6 inches above T-bar ceilings. Tape and cable ties are not approved methods of fastening cables.

F. Floor and ceiling penetrations by “open” cables will not be allowed. Provide conduit sleeves, as required plus a spare (with fire and dust stopping and sealing) where “open” cable passes through floors, walls, partitions, etc.

G. Cable shall be unrolled from reels, or removed from cartons, and installed in a manner which will prevent kinking, crushing or excessive tension on conductors and insulation. Slack wire shall be provided at all pull points.

H. Cable shall be installed or drawn into the raceway system only after all work of any nature that might cause injury to the cable is completed. The raceway systems shall be complete (including the installation of bushings, grommets, etc.), snaked and cleaned, and approval of the installation is obtained from the Owner and Engineer, before pulling any cable.

I. Cable pulling lubricants shall be used to minimize pulling stresses on cable pulled into raceways.

J. Replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, and over tightened bindings.
3.06. EQUIPMENT TESTING

A. Before testing, visually inspect equipment thoroughly, and perform mechanical operation tests in accordance with manufacturer’s instructions.

B. Lighting Control System:

1. Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas.

2. Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.

3. Before Substantial Completion, arrange and provide an Owner instruction period to designated Owner personnel. Set-up, commissioning of the lighting control system, and Owner instruction includes:
   a. Confirmation of entire system operation and communication to each device.
   b. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors.
   c. Confirmation of system programming, photocell settings, override settings, etc.
   d. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

4. Comply with energy code lighting control system “Acceptance Requirements”. Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party certify that controls are installed and calibrated properly.

C. Lighting Control Devices:

1. Each individual room shall be configured in either a manual-on/auto-off or auto-on/auto-off configuration, as required by Washington State Energy Code.

2. Stand-alone occupancy sensors shall be individually tested and the test results documented. Verify that the occupancy sensors detect motion in the controlled space immediately when the room is entered. Record the amount of time that the lights stay on after the room is vacated. Delay times shall be programmed as follows:
   a. Offices: 30 minutes.
   b. Restrooms: 30 minutes.
   c. Corridors: 15 minutes.
   d. Storage Rooms: 5 minutes.
   e. Utility Rooms: 5 minutes.
3. Wall switch occupancy sensors shall be configured for the optimal setting for the space in which they are installed. Factory default settings are typically not acceptable. Verify settings with the Engineer prior to installation.

4. Daylight harvesting photosensors shall be individually tested and the test results documented. Verify that the photosensor controls light fixtures in a continuous dimming configuration with rising and falling ambient light levels. Record the foot-candle level on the work surface and the corresponding footcandle measurement of the photosensor. Maintained foot-candles at the work surface shall be as follows:
   b. Corridors: 20 foot-candles.
   c. Storage Rooms: 20 foot-candles.
   d. Utility Rooms: 20 foot-candles.

5. Comply with energy code lighting control system “Acceptance Requirements”. Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party certify that controls are installed and calibrated properly.

3.07. DEMONSTRATION & TRAINING

A. Lighting Control Systems and Devices:

1. Before Substantial Completion, arrange and provide an Owner instruction period to designated Owner personnel. Set-up, commissioning of the lighting control system, and Owner instruction includes:

   a. Instruction in and confirmation of entire system operation and communication to each device.

   b. Confirmation of operation of individual relays, switches, occupancy sensors, daylight sensors, etc.

   c. Confirmation of system programming, photocell settings, override settings, etc.

   d. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

B. The person(s) who conduct these instructions and demonstrations shall be a qualified representative(s) of the manufacturer with substantial training and operating experience on this equipment and project, and shall be versed in the operating theory as well as practical operation and maintenance work. Instructor(s) shall have the necessary educational and interpersonal skills, as well as proven ability to effectively perform the training. Their qualifications shall be submitted to the Architect before conducting the instruction period.
C. Include a preliminary discussion and presentation of information using the actual Operation & Maintenance Manuals required for this project. Contractor shall notify Architect at least 14 days in advance of readiness to conduct the instruction period. The actual time and date of instruction period shall be acceptable to the Owner and Engineer.

D. All training material shall be furnished and supplied by the Contractor.

End of Section 26 50 00
PART 1 – GENERAL

1.01. APPLICABLE PROVISIONS

A. The General, Supplementary and other Conditions of the Contract, modifications to the General Conditions, the Drawings, and the applicable provisions of the other Divisions are hereby made a part of this Division and all its sections.

1.02. SUMMARY

A. The requirements of this Section and the other Division 26, 27 & 28 Sections apply to the telecommunications systems work.

B. Coordinate telecommunications systems work with related work shown and specified elsewhere.

C. The Contractor shall perform all the work required (including the furnishing of all supervision, labor, services, tools, materials and equipment and the performance of all operations and incidentals necessary) for a complete, safe and reliable telecommunications system installation, adjusted, tested and ready for operation. The work is generally described as follows:

1. Equipment backboards.
2. Voice and data horizontal cabling infrastructure.
3. Cable supports and racks.
4. Equipment racks, complete with:
   a. Vertical wire management.
   b. Horizontal wire management.
   c. Fiber termination housing, splice housing, jumper management panel, etc.
   d. Patch panels.
   e. Space for Owner provided electronic data system.
5. Wireless access point enclosures.
7. Individual and/or combination voice and data stations/outlets and associated cables, etc.
8. Terminating all cables on both ends - voice, data, grounding, backbone, station, copper, fiber optic (single-mode and multimode), etc.
9. Moisture, fire and dust stopping and sealing.

10. Nameplates and labeling.

11. Equipment, device, cabling, etc. identification and records.

12. Testing and completing.

13. Final cleaning.


15. Obtaining, and paying for all required licenses, permits, inspections, plan review and other fees, etc.

1.03. DEFINITIONS

A. The word "Telecommunications" refers to all forms of information transport and processing, such as voice (telephone), data (computer network, etc.

B. The word(s) "Station" or "Station Outlet" refers to all combination telecommunications outlets.

C. The word(s) "Station" or "Station Cables" refers to all CAT 6A horizontal cables.

D. The word "Backbone" refers to the cabling, connections, etc. between telecommunications rooms.

E. The term "Contractor" used throughout this section of these specifications and on the telecommunications drawings shall be understood to mean the Telecommunications Contractor. All other work shall be called out by name.

F. “Approved” means approved by the Architect. “For approval” means for the Architect’s approval.

G. “Furnish” means to supply and deliver to the Project, ready for installation and in operable condition.

H. “Install” means to incorporate in the work in final position, complete, mounted, anchored, connected, and in operable condition.

I. “Provide” means furnish and install.

J. “As directed” means as directed by the Architect.

K. “Concealed” means hidden from sight in trenches, walls, chases, ceilings, etc.
L. “Exposed” means within sight; that is, not concealed as defined above, and installed on the surface of walls, ceilings, etc.

M. “C.O.” means conduit only; that is, without cable (except, provide pull string).

N. “F.O.I.C.” means Furnished by Others (e.g. general contractor, other subcontractors, equipment suppliers, Owner, systems contractors working directly with the Owner, etc.), Installed by Contractor.

O. Definitions of all other terms, etc. are in accordance with AIA, ANSI, IEEE, IES, NEMA, etc. standard definitions.

1.04. DRAWINGS AND SPECIFICATIONS

A. The telecommunications plan drawings are general in form and do not attempt to show complete details or list every item of the telecommunications systems, the building construction or the various equipment; however, the routing of raceways and circuits, and the locations of equipment, devices, fixtures, etc. represent the desired finished arrangement; except, as governed by structural or mechanical conditions or obstructions.

B. Specifications are, in some cases, written in an abbreviated form. Words such as shall, shall be, the Contractor shall, and similar mandatory phrases are supplied by inference.

C. Investigate the structural and finish conditions affecting the work. Refer to the architectural, structural and mechanical drawings, supplier shop drawings and submittals, etc. for additional details, equipment ratings, dimensions, location and swing of doors, location and size of partitions, cabinets, etc. and similar features. Verify all dimensions, equipment ratings, etc. with the actual before installation. Arrange the work accordingly.

D. The intent of the drawings and specifications is to include all items necessary for the proper execution and completion of the Work; however, any item or detail not specifically mentioned in the specifications or shown on the drawings, but which is necessary to produce the intended results shall be included.

E. The Contractor shall bring to the Architect’s and Engineer’s attention any discrepancies within the Contract Documents, between the Contract Documents and field conditions, and any design and layout changes required due to specific equipment selection, etc. prior to equipment and material purchasing and installation. Corrective work necessitated by discrepancies after purchasing and installation shall be at the Contractor’s expense.

F. Verify all equipment and device locations with the Owner and Architect prior to rough-in
1.05. SUBMITTALS

A. Provide product submittals for the following:
   1. Station cable.
   2. Workstation termination hardware.
   3. Patch panels.
   4. Telecommunications room termination hardware.
   5. Backbone cable.
   6. Backbone cable termination hardware.
   7. Equipment racks and cabinets.
   8. Cable supports.
   9. Grounding busbars & ground lugs.
   11. Labels.

B. The Contractor shall submit proposed procedures and equipment to be used in testing voice and data cabling along with samples of the reporting format from a past similar project.

C. Provide qualification information for persons installing and testing the components (equipment, devices, materials, etc.) of each system, indicating their capabilities and experience. Include evidence of applicable registration or certification.

D. Prepare detail layout drawings to a larger scale than the contract drawings in areas where the work is of sufficient complexity to warrant additional detailing. Prepare these drawings on tracings the same size as the contract drawings.

1.06. RECORD DOCUMENTS

A. Submit "as-built" record drawings and operation and maintenance manuals at completion of the project in accordance with the specific submittal requirements listed elsewhere in these Specifications.

B. Provide as-built documentation consistent with the contract documents as required, in AutoCAD .dwg files with as-built notations for all sheets. (Consultant/Engineer will provide construction drawings AutoCAD files to contractor.)

C. Provide cable test results in both paper copy and software form in an electronic format approved by the owner, except, for station cables and intra-building voice backbone cables provide only a summary in paper copy and complete test results for individual station cables in software form.

1.07. "AS BUILT" DRAWINGS

A. “As-built” drawings shall include cable ID codes for each outlet/receptacle and changes to cable routing, raceway system, telecom room layout, riser diagram, etc.
B. Include any detailed equipment, raceway, wiring, etc. diagrams and layouts prepared by Contractor or his subcontractors, suppliers, etc.

1.08. WARRANTY

A. The complete installation shall be guaranteed for a period of one (1) year after date of project completion. For warranty purposes, the date of project completion shall be considered the date of final acceptance of the installation by the Owner certified in writing, and after Owner has received all project close-out requirements. All corrective work, if needed and requested by the Owner, shall be provided without cost to the Owner during the guarantee period.

B. The contractor shall provide the manufacturer 20-year Extended Product Warranty on the completed voice and data cable infrastructure end-to-end solution. The warranty shall be provided by the manufacturer of the voice and data termination hardware.

C. The contractor shall provide any available third party or manufacturer warranties on the installation.

1.09. QUALITY ASSURANCE

A. Contractor and Contractor’s personnel shall be experienced, thoroughly trained and completely familiar with telecommunications infrastructure, systems, equipment, devices, materials, etc. and the required methods of installation.

B. Contractor Qualifications:

1. The Contractor shall be a "specialist", who is regularly engaged in the type of work specified herein. Award will be made only to a bidder who can provide satisfactory evidence that he has the technical ability, experience, tools, personnel and financial resources to successfully complete the project as specified herein. The Contractor shall have an experience base of at least five (5) years for installation of equipment and related wiring/cabling similar to those proposed on this project.

2. The Contractor shall be registered and certified with the manufacturer of the voice and data end-to-end solution, and shall be capable of providing the required end-to-end solution warranty.

3. The Contractor shall engage experienced testing technicians for the purpose of testing the cabling systems. If requested by the Owner, the Contractor shall submit qualifications of the cable testing technician(s) for Owner review and acceptance.

4. The Contractor shall be licensed and bonded in the State of Washington.
C. Manufacturer Qualifications: Engage firms experienced in manufacturing components and materials listed and labeled under the applicable TIA/EIA standards (accepted, proposed or draft).

D. Installation, equipment and materials shall be in accordance with all applicable codes, standards and regulations; including the latest editions and addenda of the following:

2. ANSI/NECA/BICSI 568 – Installing Commercial Building Telecommunications Cabling.
4. ANSI/TIA/EIA 526 – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
5. ANSI/TIA/EIA 526 – Optical Power Loss Measurements of Installed MultiMode Fiber Cable Plant
14. ANSI/TIA/EIA 598 – Optical Fiber Cable Color Coding.
15. ANSI/TIA/EIA 606 – Administration Standard for Commercial Telecommunications Infrastructure.
16. ANSI/TIA/EIA 607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.

PART 2 – PRODUCTS

2.01. GENERAL

A. Coordinate the features of materials and equipment so they form an integrated system. Match components for optimum performance and appearance.

B. Horizontal cabling infrastructure shall be selected and constructed as a complete end-to-end solution by Hubbell, OCC/Hitachi, Ortronics or Systimax.

C. Unless sizes and/or quantities are specifically indicated, provide at least 20% spare wiring capacity in all cabinets, panels, cable trays and raceways.
D. All telecommunications equipment, devices, materials, etc. shall be new and installed only if in first class condition.

E. All wire and cable installed in below grade raceways shall be suitable for wet locations.

2.02. VOICE (TELEPHONE) AND DATA (COMPUTER NETWORK) STATION CABLES

A. Voice and data station cable shall be 4 pairs, twisted, #23 AWG solid copper, nominal 100 ohm, Category 6A F/UTP (foiled/unshielded twisted pair) cable, 300 volt rated. Cable shall be tested and certified by the manufacturer at up to 500 MHz and shall provide positive ACR beyond 250 MHz. Cable shall support ANSI X3.263 (100 Mbps), IEEE 802.3 1000Base-T (Gigabit Ethernet), ANSI/TIA/EIA 854 1000Base-TX (Gigabit Ethernet) and IEEE 802.3an 10GBase-T (10 Gigabit Ethernet). Cable shall conform to or exceed ANSI/TIA/EIA568 Category 6A Cabling requirements and ISO/IEC Class EA cabling requirements. Additionally, the cable shall meet or exceed all the following performance criteria:

<table>
<thead>
<tr>
<th>Performance Criteria</th>
<th>@250 MHz</th>
<th>@500 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Maximum Attenuation (dB/100M)</td>
<td>31.1</td>
<td>45.3</td>
</tr>
<tr>
<td>2. Minimum NEXT (dB)</td>
<td>38.3</td>
<td>33.8</td>
</tr>
<tr>
<td>3. Minimum PSNEXT (dB)</td>
<td>36.3</td>
<td>31.8</td>
</tr>
<tr>
<td>4. Minimum ACR (dB)</td>
<td>7.3</td>
<td>-11.4</td>
</tr>
<tr>
<td>5. Minimum PSACR (dB)</td>
<td>5.3</td>
<td>-13.4</td>
</tr>
<tr>
<td>6. Minimum ACRF (dB)</td>
<td>19.8</td>
<td>13.8</td>
</tr>
<tr>
<td>7. Minimum PSACRF (dB)</td>
<td>16.8</td>
<td>10.8</td>
</tr>
<tr>
<td>8. Minimum TCL (dB)</td>
<td>26.0</td>
<td>---</td>
</tr>
<tr>
<td>9. Minimum RL (dB)</td>
<td>17.3</td>
<td>15.2</td>
</tr>
</tbody>
</table>

B. Cable shall consist of 4 unshielded insulated conductor pairs with an overall foil shield and drain wire. Cable shall not utilize bonded pairs. Cable shall be of a standard round design, with an overall jacket. Jacket shall be blue.

C. Cable shall be riser rated, be listed as being resistant to the spread of fire and bear flammability testing ratings as communications cable type CMR.

D. Cables installed in exterior or below grade conduits shall not be required to be UL listed and shall have a water-blocking gel, be suitable for wet locations and have a black jacket. Cables shall be CAT6A rated, and shall be allowed to be UTP jacketed, without and overall shield.

E. All cables shall be of the same manufacturer, Berk-Tek LANmark-10G FTP, Hitachi Supra 10G, Hubbell NextSpeed Ascent, OCC CAT6A F/UTP, Superior/Essex Category 6A ScTP, Commscope GigaSPEED X10D or approved equal.
2.03. VOICE (TELEPHONE) BACKBONE CABLES

   A. Outside Plant voice backbone cables shall be multi-pair, twisted into varying lays, #24 AWG solid copper, Category 3 Filled ALPETH type. Individual conductors shall have high density polyethylene insulation and use standard color codes for pair identification. Cables shall be filled with water blocking gel, have a corrugated aluminum shield and an overall polyethylene jacket, and be suitable for use in direct burial applications.

2.04. DATA (COMPUTER NETWORK) BACKBONE CABLES

   A. Data cable shall be fiber optic cable, single or multimode breakout type, with 12 strands of 62.5/125 µm multimode and 12 strands of 9/125 µm single-mode fibers, tight buffered, suitable for use either inside or in outside plant applications. Cables shall consist of multiple sub-cables helically stranded around a central dielectric strength member, aramid fillers as required and an outer jacket.

   B. Sub-units shall be tight buffered optical fiber, 900µm diameter, with aramid yarn strength filler and jacket, color coded per TIA/EIA - 598A to provide easy identification of multimode fibers, and designed for direct termination to standard connectors.

   C. Fibers shall be free of surface imperfections and inclusions, and comply with the applicable sections of TIA/EIA - 455, - 472, - 492, - 568A and - 598A.

   D. Optical characteristics:

      1. 50/125 µm multimode fibers [OM3 grade]
         a. Gigabit Ethernet capable: 1000 meters @ 850 nm, and 600 meters @ 1300 nm.
         b. 10 Gigabit Ethernet capable: 300 meters @ 850 nm, and 300 meters @ 1300 nm.
         c. Typical attenuation: 3.0 dB/km @ 850 nm, and 1.0 dB/km @ 1300 nm.
         d. Maximum attenuation: 3.0 dB/km @ 850 nm, and 1.0 dB/km @ 1300 nm.
         e. Minimum LED bandwidth: 1500 MHz-km @ 850 nm, and 500 MHz-km @ 1300 nm.
         f. Minimum LASER bandwidth: 2000 MHz-km @ 850 nm, and 500 MHz-km @ 1300 nm.
         g. ISO/IEC 11801 designation: OM3.
         h. Optical Cable Corporation fiber code ALT.

      2. 9/125 µm, .5/.5 single-mode fibers
         a. Gigabit Ethernet capable: 5 km @ 1310 nm, and 5 km @ 1550 nm.
b. 10 Gigabit Ethernet capable: 10 km @ 1310 nm, and 10 km @ 1550 nm.

c. Maximum attenuation: = 0.5 dB/km @ 1310 nm, and 0.5 dB/km @ 1550 nm.

d. “Low Water Peak” attenuation characteristics.

e. ISO/IEC 11801 designation: OS2.

f. Optical Cable Corporation fiber code SLX.

E. All fibers shall be subjected to a minimum proof test of 0.7GPa.

F. Cable shall be riser rated, listed as being resistant to the spread of fire, bearing flammability testing ratings as non-conductive optical fiber cable type "OFNR".

G. Fiber optic cable shall be Optical Cable Corporation BX series, Commscope Premises Riser Breakout, or General Breakout series.

2.05. COPPER CABLE TERMINATION HARDWARE

A. Voice & data station cable patch panels shall be standard foot print (straight), 48 port, 2 rack units in height, with modular jack openings, supplied with un-loaded modular jacks and transparent label holders. Modular jacks shall be type RJ-45, 8-position, non-keyed conforming to T568B specification in ANSI/TIA/EIA-568 standard for shielded category 6A. Patch panels shall provide a continuous ground path for each module. Panels shall be Hubbell, OCC Ortronics, Systimax or approved equal. Provide the number of patch panels/ports required plus 30% spare, except minimum as indicated on the drawings.

B. Voice backbone patch panels shall be 24 port, rack mounted, category 3, modular to 110 type with 6 port modules and transparent label holders. Module jacks shall be 1 pair, 8 position, non-keyed conforming to TIA and ISO category 3 performance requirements. Patch panels shall be 1 or 2 rack units in height as indicated.

C. Horizontal cable management panels shall be 1 or 2 rack units in height as indicated, mounted to the front of a standard 19 inch equipment rack.

D. All patch panels, 110 blocks, clips, cable management, etc. shall be of the same manufacturer, Hubbell, OCC, Ortronics or Systimax and specifically designed for use together.

2.06. FIBER OPTIC TERMINATION HARDWARE

A. Splice trays for use in existing termination panels shall be size and type as required to accommodate the fusion splices and fit within the existing termination panels.
B. Data Backbone Fiber Optic Cable Connectors:

1. Multimode fiber optic cable connectors shall be optical fiber, epoxy & polish, simplex SC type with self-centering axial alignment mechanisms, zirconia ceramic ferrules and composite housing. The connector boot shall be installed over the 2.5mm or 900 µm sub-cable. Maximum insertion loss shall be .5dB. Minimum tensile strength shall be 20 lbs.

2. Single-mode fiber optic cable connectors shall be factory assembled pigtails terminated with type SC-APC angle polished connectors with ceramic insert alignment sleeves and green in color. Return loss shall be 65 dB or better. Fusion splice pigtails to backbone fiber optic cables. Pigtails shall be 2 meter jumpers cut in half to make 2 pigtails.

3. All fibers in each cable shall be terminated to connectors, couplings, etc. as required in optical fiber enclosures.

C. Optical fiber termination enclosures in equipment racks shall be rack-mounted, as manufactured by Corning to match existing on campus, as follows:

1. Fiber termination housing, 24 port (Corning CCH-02U), with simplex 6 fiber SC-APC and SC connector panels as required to fill housing. Single-mode fiber optic couplings shall be SC-APC angle polished type to match connectors, with ceramic insert alignment sleeves and shall be green in color. Multimode fiber optic couplings shall be SC type to match connectors, with ceramic insert alignment sleeves.

2. Fiber splice housing shall be 24 splice capacity (Corning CJH-02U) with the required quantity of splice trays and a jumper management panel (Corning CJP-02U)

3. Enclosures and all components shall be specifically designed for use together and be complete with all necessary hardware, accessories and appurtenances.

D. Optical fiber splices shall be heat fusion type and shall include a protective covering to prevent damage to the splice.

2.07. STATION HARDWARE

A. Telecommunications outlets and station hardware shall consist of boxes, faceplates (wallplates), voice receptacles (jacks), data receptacles (jacks), blank inserts, labels, etc. as indicated. Faceplates, receptacles, connectors, etc. shall be heavy duty modular type, of the same manufacturer, Hubbell, OCC KMJ series, Ortronics, or Systimax, and designed for use together.

B. Voice and data receptacles shall be RJ45 jacks, die-cast metal body, non-keyed with gold plated spring wire contacts and 110 style wire terminations. Jacks shall meet ANSI/TIA/EIA-568 Standard for shielded Category 6A connecting hardware and be configured in accordance with designation T568B eight position jack pin/pair assignment.
C. Voice and data receptacles for use in floor boxes shall be keystone standard compatible.

D. Faceplates (wallplates) shall be commercial grade, single or double gang, as required, high impact flame retardant thermoplastic, white colored, 4 port, with transparent label windows on top and bottom. Faceplates shall be labeled as directed. Provide blank inserts in all unused ports.

E. Wall mount type telephone faceplates shall be 8 conductor, wired to TIA-568B, with 110 style wire terminations, stainless steel faceplate and telephone mounting posts.

F. Individual telecommunications outlets shall be mounted in flush wall mounted boxes or combination floor boxes, as indicated.

G. Telecommunications outlets surface mounted in mechanical, utility, etc. type rooms shall be mounted in steel, single-gang, 2 1/8” deep boxes.

2.08. WALL MOUNTED EQUIPMENT RACKS

A. Wall mounted equipment rack shall be fully enclosed type, black color, 36 inches high x 24 inches wide x 18 inches deep, wall mounted, with adjustable rack rails, universal mounting hole pattern, metal door and fan kit. Cabinet shall be Chatsworth Products Cube-IT, or approved equal.

B. Provide all necessary mounting brackets, plates, pans, shelves, hardware, etc. (modified if necessary) for equipment, termination housings, etc.

2.09. CABLE SUPPORTS

A. Supports for cables run “open” above ceilings and the like shall be wide base type J-hook assemblies. Supports shall be made of galvanized steel and have minimum 2” diameter.

B. Supports for attachment to drop wires shall be capable of minimum 25 lb load capacity.

C. Bundle cables with double sided Velcro straps. Tie-wraps shall not be allowed.

D. Support spacing shall not exceed 5 feet.

2.10. PULL STRING AND ROPE

A. Pull string shall be resistant to rot and mildew and shall not deteriorate when exposed to oil, grease, etc.
B. Pull rope shall be flat, woven polyester tape, minimum 1800 tensile strength. Rope shall be pre-lubricated to reduce pulling tension and shall be durably printed with sequential footage markings. Rope shall be resistant to rot and mildew and shall not deteriorate when exposed to oil, grease, lubricants, etc. Where installed in underground conduits, the pull rope shall have a # 22AWG detectable tracer wire woven into the tape. Pull rope shall be Neptco Muletape, or equivalent.

2.11. GROUNDING

A. Telecom Grounding Busbar (TGB) shall be a prefabricated assembly, solid copper, minimum \( \frac{1}{4} \) inch thick x 4 inches high x 12 inches long, complete with insulators, mounting brackets and hardware. Ground bars shall be pre-drilled with both \( \frac{1}{4} \) inch diameter holes spaced on \( \frac{3}{8} \) inch centers and \( \frac{3}{8} \) inch diameter holes spaced on 1 inch centers for two-hole lugs in compliance with the ANSI/TIA/EIA 607 recommendations. TMGB shall be B-line model SB477, Chatsworth Products model 40153-010, Eritech model TMGB-A14L15PT, Harger model GBI14412TMGB, or approved equal.

B. If required, the contractor shall drill additional \( \frac{1}{2} \) inch diameter holes spaced on \( \frac{3}{4} \) inch centers for two-hole lugs on large cables. The Contractor may not elect to fabricate the ground bars.

C. Ground cable shall be single conductor stranded copper with 600 volt type XHHW or THWN/THHN insulation. Conductor size shall be minimum # 6 AWG unless noted otherwise. Conductor insulation for # 2 AWG and smaller cables shall be green color; insulation for # 1 and larger cables may be black with green marking tape applied in telecommunications rooms.

D. Ground lugs, clamps, nuts, washers, etc. shall be corrosion resistant high copper alloy or silicon bronze. Cable-to-cable connectors shall be copper, compression type.

E. Cable lugs at ground bars, equipment, racks, etc. shall two-hole bolt-on compression type, long barrel, \( \frac{5}{8} \) inch hole spacing for # 6 AWG and smaller cables, 1 inch hole spacing for # 4 AWG through # 1/0 AWG cable and \( \frac{3}{4} \) inch hole spacing for # 2/0 AWG and larger cable. Mounting bolts shall be \( \frac{1}{4} \) inch, \( \frac{3}{8} \) inch or \( \frac{1}{2} \) inch diameter (as required), with hex head bolts, beveled or spring type washers, lock washers and hex head nuts; Thomas & Betts 548 series or Burndy YA series (no exceptions).

2.12. NAMEPLATES AND LABELS

A. Provide identification tags with labels for the following:

1. Backbone cables, on both ends and at each pathway junction point (e.g. entrance/exit of conduits or raceways), and at 100 foot intervals in open cable tray systems. Labels shall identify the cable type, function, origin and destination.

B. Provide labels for the following:
1. Backbone cables, on both ends and at each pathway junction point (e.g. entrance/exit of conduits or raceways), and at 100 ft. intervals in open cable tray systems. Labels shall identify the cable type, function, origin and destination.

2. Voice and data station cables, at both ends, with the cable ID code.

3. Ground cables, with cable origin and destination.

4. Telecommunications faceplates, with the voice and data cable ID codes.

5. Voice and data cable termination hardware, with the cable ID codes.

6. Fiber optic termination housings.

C. Nameplates, labels, identification tags, etc. shall utilize identifier formats consistent with the ANSI/TIA/EIA 606 standard. Submit proposed inscriptions to Owner for approval prior to construction.

D. Font size, color and contrast for all labels shall be in accordance with the ANSI/TIA/EIA 606 standard.

E. All labels shall be neatly typed or generated with a mechanical labeling device.

F. All labels shall be long lasting and durable, resistant to heat, moisture, solvents, oil, etc.

G. Cable ID code, labeling scheme, etc. will be provided to the Contractor by the Owner and Engineer. Submit a sample of the proposed labels to Owner for approval prior to installation.

2.13. EQUIPMENT BACKBOARDS

A. Equipment backboards shall be 3/4 inch plywood, void free, interior grade, good one side, fire resistant treated, bearing a quality mark indicating compliance with American Wood Preservers Assoc. (AWPA) standards.

B. Paint with minimum two coats of light colored fire resistant paint on all sides and edges.

2.14. ANCHORS AND FASTENERS

A. Anchors and fasteners used shall be of a type designed for use in the base material to which the item is to be attached. Attach to wood with wood or lag screws, to metal with machine screws or bolts and to concrete with carbon steel wedge or sleeve type expansion anchors or self-drilling metal anchors and machine screws or bolts.

B. Pad and floor mounted equipment shall be secured with suitable hot dipped galvanized steel anchor bolts, washers, hex nuts, etc.
C. Powder actuated fasteners, plastic expansion type anchors, nails and toggle bolts are not permitted.

D. Anchors shall be non-corrosive or have suitable corrosion resistant coatings or treatment.

E. Bolts, nuts, screws and other threaded devices shall have standard threads and heads, unless required for tamper-proof installation.

PART 3 - EXECUTION

3.01. DEMOLITION

A. Telecommunications cables indicated as to be removed shall be removed from their point of origin to destination, except, modern CAT6 cables shall be pulled back to the nearest cable tray, coiled out of sight and labeled for future use.

B. Where demolition work effects the building tenants and operations, coordinate work with the owner, tenants and respective service providers.

3.02. LOCATIONS

A. Outlets shall be mounted 18 inches to centerline above finished floor unless noted otherwise; except, outlets above counters, etc. shall be mounted 6 inches to centerline above the counter or 3 inches to centerline above the splashboard, whichever is higher.

B. Wall mounted and emergency telephones shall be mounted 48 inches to highest operable component above finished floor unless noted otherwise.

C. Coordinate the location and mounting requirements for payphone outlets with the service provider prior to rough-in.

3.03. COORDINATION OF THE WORK

A. Where work may affect University standards or operations, coordinate the work of this Section with Owner's Telecommunications Department.

1. Meet jointly with the Owner's representative and representatives of the Telecommunications Department to exchange information and agree on schedules, and details of equipment arrangements and installation interfaces.

2. Record the agreements reached in these meetings and distribute the records to all participants.
3. Schedule the work to avoid unreasonable disturbance or interruption of University operations.

4. Adjust the arrangements and locations of equipment and cabling supports in affected rooms and spaces to accommodate and optimize the room or space arrangements.

B. Schedule the work to avoid disturbance or interruption of Owner’s operations in adjacent spaces and access pathways.

C. Coordinate work schedule to facilitate installation of active electronic equipment and cut-over of services.

3.04. WIRES AND CABLES

A. Inspect cable prior to installation to verify that it is identified properly on the reel or box identification label, is of proper gauge, containing correct number of pairs, etc. Note any buckling of the jacket which would indicate possible problems. Damaged cable or any other components failing to meet specification shall not be used in the installation.

B. Telephone/voice and computer/data cables shall be homerun to the Communications Room without splices or taps and terminated in patch panels in an equipment rack.

C. All exposed power limited telecommunications cable shall be run in metal raceways, except where specifically approved otherwise.

D. All concealed power limited telecommunications systems cable may be run “open” in accessible ceilings; except, where indicated otherwise and where penetrating through ceilings, floors, walls, draft-stops, etc.

E. "Open" cables shall be bundled and supported from permanent structural members of the building, either directly or indirectly, with suitable hooks. Support spacing shall not exceed 5 feet. Protect “open” cables during installation in ceiling spaces. Cables shall not interfere with the removal of pipes or equipment for maintenance or repair. All "open" cable shall be kept a minimum of 6 inches from pipes, ducts, and other items producing heat. Support "open" cables a minimum of 6 inches above T-bar ceilings. Cables shall be bundled using double sided Velcro straps. Tape and tie-wraps are not approved methods of bundling or supporting cables.

F. Floor and ceiling penetrations by “open” cables will not be allowed. Provide conduit sleeves, minimum 2" EMT, as required plus a spare (with fire and dust stopping and sealing) where “open” cable passes through floors, walls, partitions, etc.

G. Cable shall be unrolled from reels, or removed from cartons, and installed in a manner which will prevent kinking, crushing or excessive tension on conductors and insulation.
H. Slack cable shall be provided at both ends of the cable and at all major pull points to accommodate future changes to the cabling system. A minimum 12 inches shall be provided at the outlet locations, coiled in the accessible ceiling space, where available, or in the surface mounted raceway system.

I. Cable shall be installed or drawn into the raceway system only after all work of any nature that might cause injury to the cable is completed. The raceway systems shall be complete (including the installation of bushings, grommets, etc.), snaked and cleaned, and approval of the installation is obtained from the Owner and Engineer, before pulling any cable.

J. Telecommunications cable shall be installed without sharp bends (less than 2 inch radius) or pulling tension in excess of 20 pounds.

K. Cable pulling lubricants shall be used to minimize pulling stresses on cable pulled into raceways.

L. All cable is subject to subtle damage that may degrade future performance, if abused during installation. In all cable installation, set reels and use sufficient pulleys and manpower so that cables are not pulled around corners or against material that might cause chafing.

M. In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Adhere to manufacturers recommended minimum bend radius and maximum pull tension for cables; except, not less than 2 inch bending radius and pulling tension in excess of 20 pounds.

N. Cable lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. (Ideal Yellow 77 is not approved.) Recommended Products:

1. Twisted-pair cable: Dyna-Blue, American Polywater
2. Optical fiber cable: Optic-Lube, Ideal

O. Replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, and over tightened bindings.

P. Replace or rework UTP cables that are improperly terminated. Terminations shall not be loosely twisted, overly twisted or have the cable sheath removed more than ½ inch.

3.05. PULL STRINGS AND ROPE

A. Provide pull ropes in all below grade telecommunications conduit and duct (with or without cables).

B. Provide pull string in all above grade telecommunications conduits (with or without cables).
3.06. CABLING CONFIGURATION

A. Cable installation in the telecommunications closets shall conform to the requirements of the TIA/EIA Standards and the project documents. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, network equipment, access hatches to air filters, switches, electrical outlets, electrical panels and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

B. Cable shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not be supported from existing electrical conduit or other equipment. Minimum bend radius shall be observed.

C. Bundle all similarly routed cables together, and attach by means of support saddles screwed to the backboard, then routed vertically and/or horizontally via "square" corners over a path that will offer minimum obstruction to future installations of equipment, backboards, or other cables. Observe cable bend radius.

D. Cables shall be bundled together by means of Velcro straps. Do not over tighten Velcro straps on station cables. Tie-wraps shall not be used as a means of support or bundling.

3.07. VOICE AND DATA STATION CABLE TERMINATION

A. Terminate all voice and data station cables on patch panels and at stations in accordance with ANSI/TIA/EIA Standards and accepted industry practice. Bundle together and support cables at the equipment rack in a neat and workmanlike manner. Reduce untwisting of copper pairs by stripping back only as much cable jacket as is required to perform connecting hardware terminations, except maximum $\frac{1}{2}$ inch.

B. Where existing voice and data cables are re-routed and/or relocated, terminate the cables using new jacks. Existing jacks shall not be re-used.

3.08. VOICE BACKBONE CABLE TERMINATION

A. Voice backbone cables in telecommunications rooms shall be terminated on patch panels, 110 hardware or primary protectors, as indicated, in accordance with ANSI/TIA/EIA Standards and accepted industry practice. Provide appropriate ground lugs for shielded cables and ground to the TMGB as indicated.
B. Voice backbone cables in new or existing splice cases shall be spliced to new and/or existing cable pairs, as indicated, with 25 pair in-line splice modules in accordance with ANSI/TIA/EIA Standards and accepted industry practice. Provided appropriate ground lugs for shielded cables and bond to the shields of all other cables in the splice case. Bonding shall provide both electrical continuity and physical stability for the cable.

C. Where existing splice cases are modified, the contractor shall provide new or modify existing end caps to ensure the physical integrity of the splice case.

3.09. FIBER OPTIC CABLE TERMINATION

A. Terminations shall be performed by a manufacturer certified technician for that type of connector and shall be made in a controlled environment.

B. Fiber cables shall be installed so as to protect the optical fibers and connectors from strain and physical damage. The minimum recommended bending radius shall not be exceeded during cable termination and placement.

C. Splices shall be heat fusion type, performed with high quality fusion splice device. Provide splice trays, protective covers, splice sleeves, etc. as require or as recommended by the manufacturer. Mechanical splices will not be allowed.

D. The contractor shall bundle the optical fiber strands in the termination and splice cabinets in a neat and workmanlike manner. Optical fiber strands shall not impede access to the splice trays or splice tray holders for future expansion and/or inspection.

E. The contractor may choose to have the cables assembled off-site, although testing must be completed with the cable in its final installed condition.

3.10. EQUIPMENT RACKS AND CABLE RACKS

A. All equipment racks and cable racks shall be anchored to the floor and bolted to the walls in accordance with manufacturer recommendations and industry standards.

B. Lag bolts used to mount equipment racks to wood structure shall be $\frac{1}{2}$" diameter and shall be bolted through the depth of the wood structure, except, minimum 3" depth.

C. Brace all equipment, equipment racks, cable racks, etc. as required to meet the requirements of Seismic Design Category D.

3.11. GROUNDING

A. Ground/bond the Telecom Main Grounding Busbars to the ground lug at the building main electrical service neutral grounding point with minimum #2 AWG cable or larger if indicated.
B. Ground/bond the Telecom Main Grounding Busbars to the building metallic water piping with minimum #2 AWG cable.

C. Ground/bond all sections of the telecommunications raceway system to the Telecom Grounding Busbars with a minimum # 12 AWG cable. The ground wire shall be run alongside the telecommunications cables and bonded to physically isolated raceway system components throughout the facility (i.e., conduit sleeves, consolidation panels, telecommunications cable tray, access point enclosures, etc.), except 1" conduit stubs less than 10 feet in length from outlet locations up to ceiling spaces are not required to be grounded.

D. Ground/bond the telecom cable trays and conduits entering the Telecom Rooms to the with minimum # 6 AWG cable.

E. Before grounding connections are made, contact surfaces shall be thoroughly cleaned and anti-oxidant solution applied.

F. Connections shall be both mechanically and electrically secure. Torque connecting hardware in accordance with the manufacturer's instructions and recommendations.

G. Torque connecting bolts at telecommunications grounding busbars to 35 ft/lbs.

H. Tests shall be made to verify the continuity of the ground system and all ground fault return paths.

3.12. OUTLETS

A. Outlet boxes shall be securely attached to walls or structural/framing members with approved anchors and fasteners. Use of adhesive tape for this purpose shall not be permitted.

3.13. CLEANING

A. Remove trash, combustible material, and other debris from telecommunications rooms and areas around equipment.

B. Remove shipping materials, supports, spacers, etc. from equipment, devices, etc.

C. Remove all debris from equipment, devices, etc. including all scraps of wire, metal shavings, plaster, dust, and other foreign material.

D. The top sides and interiors of all equipment and enclosures shall be vacuumed clean.

E. Remove paint splatters and other spots, dirt, and debris.

F. Touch up scratches to match original finish.

G. Remove all traces of soil, dirt, dust, smudges, fingerprints and other foreign matter from visible surfaces of equipment, devices, etc.
H. Maintain adequate ventilation during cleaning.

I. Follow manufacturer’s instructions. Failure to follow manufacturer’s recommendations when cleaning equipment can result in damage from the use of improper cleaning methods or agents.

3.14. TESTING

A. All testing shall be performed by personnel that are trained and certified in the specific task. The Contractor shall perform end-to-end installation performance tests of the cabling plant. The Contractor shall submit for approval a proposal describing the test procedures, test result forms, and timetable for fiber optic, and all copper wiring.

B. The Owner and Engineer shall be notified one week prior to any testing so that the initial testing may be witnessed.

C. The Contractor shall submit three (3) final copies of the test result documentation for all required tests (including fiber optic OTDR tracing printouts and distance test results), and provide verification that all cable tests have been completed. Test reports shall be submitted in electronic format and shall include viewing software for viewing the test report files. Documentation shall identify each cable with the designated identification description. Cables that do not meet the minimum standards as specified, at any of the required tests, shall be replaced at the Contractor's expense.

D. Fiber Optic Cable Testing:

1. The meter(s) used for all testing of optical fibers and fiber optic cables shall be calibrated and traceable to the National Institute of Standards and Technology (NIST).

2. Unless noted otherwise, all testing shall be performed in compliance with and shall meet the requirements of the following standards:

   a. ANSI/TIA/EIA 526 – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

   b. ANSI/TIA/EIA 526 – Optical Power Loss Measurements of Installed MultiMode Fiber Cable Plant


   e. ANSI/TIA/EIA 568 - Commercial Building Telecommunications Cabling Standard, General Requirements.
3. Conduct OTDR tests of each of the optical fibers (single-mode and multimode) to check for faults, end face quality, and to provide overall length using an appropriate high-resolution OTDR device.
   a. Test optical fibers on the shipping reel prior to installation.
   b. Test existing optical fibers prior to extension to new rooms.
   c. Test installed optical fibers in both directions.
   d. Test multimode fibers at 1300 nm and single-mode fibers at 1550 nm.
   e. Provide end face photographic image for each end face and reference the image to the associated OTDR trace file.
   f. Tests shall be performed using all appropriate settings recommended by the OTDR manufacturer for pulsewidth, range, resolution, index of refraction, etc.
   g. Tests shall be performed using an appropriate launch cable as required to achieve valid test results.
   h. Tests shall provide an accurate measurement of the overall cable length, connector reflection, and shall indicate the location of any anomalies or events along the entire length of the cable.
   i. Tests shall utilize markers indicating the beginning and end of the fiber strand and shall be set and recorded at the time of testing.

4. Conduct Attenuation (power meter) tests of the optical fibers (single-mode and multimode) to check for overall insertion loss using an appropriate power meter tester.
   a. Contractor shall determine the reference power reading using the single jumper method, in accordance with the applicable standards prior to testing.
   b. The test jumper shall be wrapped around a mandrel as required by ANSI/TIA/EIA 568.
   c. Conduct attenuation tests in both directions on the installed multimode cables (new and existing) at 850 nm (±30 nm) and at 1300 nm (±20 nm).
   d. Conduct attenuation tests in both directions on the installed single-mode cables (new and existing) at 1310 nm (±10 nm) and at 1550 nm (±20 nm).
   e. Power meter tests shall be recorded in software form, when available, or reported on a spreadsheet form, with the dB loss values for each direction at each wavelength and a bi-directional average.
5. Conduct end face imaging tests for each single-mode and multimode connector. Images shall be digital photographs and shall be stored and linked to the OTDR test reports. Images shall verify that the connectors are free from dirt and blemishes at the time of testing.

6. The contractor is responsible for obtaining minimum specified attenuation results and other losses in cable installation, fiber connections and polishing, etc.

7. The contractor shall perform the required testing, submit the test results to the engineer for approval and receive approval prior to connecting services to the cable plant.

E. Copper Voice/Data Cable Testing:

1. All voice station drop cables shall be tested in accordance with the “permanent link” configuration as defined in ANSI/TIA/EIA 568. The entire link (termination hardware, jacks, cables, etc.) shall pass all tests to ANSI/TIA/EIA Category 6A specifications and ISO/IEC Class EA parameters, at up to 90 meters in length.

2. Each wire/pair shall be tested for, minimum:
   a. Wiremap (polarity, pair reversals, continuity, shorts and grounds);
   b. Cable length (record all lengths);
   c. Insertion Loss;
   d. NEXT (near end cross talk);
   e. PSNEXT (power sum NEXT);
   f. ACRN (attenuation/cross-talk ratio – near end);
   g. PSACR-N (power sum ACR – near end);
   h. FEXT (far end crosstalk);
   i. ACRF (attenuation to crosstalk ratio – far end);
   j. PSACRF (power sum ACR – far end);
   k. PSANEXT (power sum alien NEXT);
   l. PSAACRF (power sum alien ACRF);
   m. Propagation delay;
   n. Delay skew;
o. Return Loss.

3. Test procedures shall be based on ANSI/TIA/EIA 568 utilizing a commercial UTP cable tester that meets or exceeds the specified accuracy requirements defined as Level IIIe for use with Category 6A and Class EA cabling systems. Each tester shall be certified as calibrated within three (3) months of testing.

4. Test results which pass within the margin of error of the tester shall not be acceptable. In the event that a cable passes the test within the margin of error, the Contractor shall determine problem(s) and make corrections as required (including replacement of the cable and/or other components if necessary) at Contractor’s expense without increase in Contract Sum. After correction(s), Contractor shall repeat tests.

F. Inter-building Voice Backbone Cable Testing:

1. Perform tests on all voice backbone cables from origin to destination. Each pair within the multi-pair cable shall be tested for continuity, ground resistance, opens, length, balance and noise. Other measurements shall also be recorded when the test equipment is capable of other measurements.

2. Tests shall be performed using a commercial subscriber loop tester; Dynatel 745, Fluke 990 or approved equal.

3. Tests shall be recorded in software form when available or manually recorded and entered into a spreadsheet format.

End of Section 27 05 00
SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.
2. Section 017300 "Execution" for field engineering and surveying.
3. Section 024116 "Structure Demolition" for demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than
underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

D. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

E. Do not direct vehicle or equipment exhaust towards protection zones.
F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. As noted on the Civil drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Upon Completion of project, remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
3.3 EXISTING UTILITIES

A. Locate, identify, and disconnect utilities indicated to be abandoned in place.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

D. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil per Geotechnical Report, in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity required to complete the project.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION
SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

   1. D 698 - "Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)."
   2. D 1140 - "Test Method for Amount of Material in Soils Finer Than the No. 200 Sieve."
   4. D 2487 - "Classification of Soils for Engineering Purposes."

C. Washington State Department of Transportation (WSDOT).
   1. "Standard Specifications for Road, Bridge, and Municipal Construction".

1.2 SUMMARY

A. Section Includes:
   1. Preparing subgrades for slabs-on-grade, walks and pavements.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for concrete slabs-on-grade.
   4. Subbase course for concrete walks and pavements.
   5. Subbase course and base course for asphalt paving.
   6. Subsurface drainage backfill for walls and trenches.
   7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.
B. Top Course: Aggregate layer placed between the gravel base course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Gravel Base Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 INFORMATIONAL SUBMITTALS

A. Stockpile Plan for approval prior to start of construction.

B. Certified test results and reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements as noted on Civil Drawings, and applicable permits required.

B. Conform to earthwork recommendations of Geotechnical Report for this Project. Coordinate Work of this Section with Architect.

1.6 PROJECT CONDITIONS

A. Architect and Geotechnical Engineer will determine suitability of site conditions for Work of this Section.
B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

C. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

D. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth moving operations.

E. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 015000 "Temporary Facilities and Controls," Section 311000 "Site Clearing," are in place.

F. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

G. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

H. Do not direct vehicle or equipment exhaust towards protection zones.

I. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

J. Control surface and subsurface water, soil erosion, sedimentation, slope, stability, and dust during Work of this Section.
PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Where sufficient approved materials are not available from required excavations on site, obtain and pay for materials from approved sources off site as noted on Civil Drawings.

B. Testing Laboratory will classify soil material, develop Proctor curve, and perform any other tests required for each soil material proposed for use as fill or backfill, whether obtained on or off site.

A. Suitable Fill:
   1. Fill: As noted on Civil Drawings and the Geotechnical report.
   2. Geotechnical Engineer/Testing Laboratory will determine appropriateness of fill material for all fills.

B. Unsuitable Material: Material not meeting criteria for Suitable Fill specified.

C. Gravel for Backfill (Structural Fill): As noted on Civil Drawings.

D. Drain Rock: As noted on Civil Drawings.

E. Slab Casting Base: As noted on Architectural and Structural Drawings.

2.2 QUALITY CONTROL

A. Prior to delivery to Site, the Testing Agency shall test all imported soil material for conformance with Contract Documents.

2.3 GEOTEXTILES

A. Separation Geotextile: Per Civil, Structural and Architectural Drawings.

2.4 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep, or other Architect and Utility approved detectable warning tape; colored as follows:

   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Provide an experienced full-time earthwork superintendent on site at all times during Work of this Section. An equipment operator, foreman, or building superintendent will not be deemed as an earthwork superintendent.

3.2 EXAMINATION

A. Verify that conditions are acceptable for start of Work of this Section. Coordinate with Geotechnical Engineer and Architect. Start of Work shall indicate acceptance of existing conditions.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

D. Retain and pay for services of a professional licensed Land Surveyor, acceptable to the Owner, to establish lines, grades, and elevations.

E. Stakes shall be firmly driven and clearly identifiable in the field. Provide additional vertical control if required.

F. Preparation of all landscape areas prior to receiving topsoil.
   1. Kill and remove any existing vegetation from surface of subgrade.
   2. Remove all stones larger than 4 inches, and all other debris larger than 1 inch which is harmful to plant life, including but not limited to concrete, asphalt, and roots. Asphalt not allowed to encroach under curbs into landscape area more than 4”.
   3. Confirm that subgrade elevations are correct and slopes for drainage are provided.
3.4 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.5 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

   2. Remove rock to lines and grades indicated to permit installation of permanent construction.

3.6 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

   2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

   3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

   1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.7 EXCAVATION FOR WALKS AND PAVEMENTS
A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.8 EXCAVATION FOR UTILITY TRENCHES
A. Excavate trenches to indicated gradients, lines, depths, and elevations.
1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated and as shown on the civil drawings.
C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
D. Trenches in Tree- and Plant-Protection Zones:
1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.9 SUBGRADE INSPECTION
A. Notify Architect when excavations have reached required subgrade.
B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
C. Proof-roll subgrade per Geotechnical requirements. Below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated on the Civil plans. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches per Structural plans and Geotechnical Engineer's recommendations.
D. Trenches under Roadways: Backfill trenches under roadways per Civil plans, Geotechnical Engineer's recommendations and Skagit County requirements.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact backfill per Civil plans and Geotechnical Engineer's recommendations

3.13 SOIL FILL

A. Place and compact fill material in layers to required elevations, per the Civil plans, Structural Plans recommendations.

B. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. If required, uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction as recommended by the Civil Engineer.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

Per Civil Drawings and:

A. Place and compact materials in maximum lifts of 8 inches loose thickness.

B. Compact each lift of fills and backfills in accordance with ASTM D 698 to minimum densities as follows:

1. Areas to be paved, including sidewalks: 95 percent.

2. Landscape areas: 90 percent.

C. Meet requirements of WSDOT Std. Specs for compaction and moisture.

D. Contractor is solely responsible to determine limits of compaction to protect against erosion.

3.16 GRADING

A. Grade to true and even surfaces. Grade to uniform levels and slopes between points where elevations are given. Round surfaces at abrupt changes in grade.

3.17 SUBSURFACE DRAINAGE
   A. Sub-drainage Pipe: As specified on Civil plans.
   B. Drainage Backfill: As specified on Civil plans.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS
   A. Place subbase course and base course on subgrades per Civil plans and Geotechnical Engineer.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE
   A. Place drainage course on subgrades per Civil plan recommendations.

3.20 FIELD QUALITY CONTROL
   A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
      1. Testing Agency will conduct compaction tests as required to certify compliance with Contract Documents. Contractor to cooperate with testing procedures and requirements.
      2. Conform to standards noted on the Civil Drawings for testing of in place material for compaction and moisture requirements.
      3. Remove and replace material not meeting specifications at no increase in Contract Sum.
   B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
   C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
   D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, recompact and retest until specified compaction is obtained.

3.21 PROTECTION
   A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION
SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, WSDOT Standard Specifications and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes construction dewatering.
B. Related Requirements:
   1. Section 013233 "Photographic Documentation" for recording preexisting conditions and dewatering system progress.
   2. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.
   3. Section 334600 "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.

1.3 QUALITY ASSURANCE
A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.4 FIELD CONDITIONS
A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
   1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
   2. The geotechnical report is included elsewhere in Project Manual.
B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing DOE notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.
D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 015000 "Temporary Facilities and Controls," Section 311000 "Site Clearing," during dewatering operations.

3.2 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

C. Remove dewatering system from Project site on completion of dewatering as required per DOE and Skagit County.

3.3 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Curbs and gutters.
   2. Walks.

B. Related Sections:
   1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Other Action Submittals:
   1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.

B. Material Test Reports: For each of the following:
   1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

C. WSDOT Std. Specs: Comply with WSDOT Std. Specs unless otherwise indicated.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

   1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
B. Form-Release Agent: Commericially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Steel reinforcement as noted on the Civil and Architectural drawings, and WSDOT standard specifications.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: As noted on the Civil Drawings.

B. Normal-Weight Aggregates: As noted on the Civil Drawings.

C. Water: Potable and complying with ASTM C 94/C 94M.


E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

2.5 CURING MATERIALS

A. Water: Potable.

B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
2.6 CONCRETE MIXTURES

A. Prepare design mixtures, per Civil drawings and WSDOT Std. Specifications, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete per the Civil drawings.

C. Add air-entraining admixture at manufacturer’s prescribed rate.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer’s written instructions.
   1. Use plasticizing and retarding admixture in concrete as required for placement and workability.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer’s recommended rate.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proceed with installation only after subgrade approval from Architect.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.
3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated on Civil drawings.

1. Locate expansion joints at intervals as shown on plans.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into
concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with WSDOT Standard Specifications for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to WSDOT Std. Specs by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as shown on Civil Drawings.
K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with WSDOT Standard Specifications Section 6-02:

M. Hot-Weather Placement: Comply with WSDOT Standard Specifications Section 6-02 when hot-weather conditions exist:

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with WSDOT Standard Specifications Section 6-02 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

3.8 PAVING TOLERANCES

A. Comply with tolerances in WSDOT Std. Specifications and as follows:

1. Elevation: 3/4 inch .
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd., 5000 sq. ft, or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

F. Concrete paving will be considered defective if it does not pass tests and inspections.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

H. Prepare test and inspection reports.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Provide water services on and off-site per the Civil Drawings and PUD requirements, Propane gas service lines as required from owner contracted tank, electrical service, Cable TV, and telephone service, as required to complete the Project and meet applicable County and PUD requirements.

1.2 SEQUENCING AND SCHEDULING

A. Arrange with Utility Companies and Districts to provide their respective services and meters. Coordinate the Work as required to complete the Project.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SECTION
SECTION 33 30 00
SANITARY SEWER

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Earth Moving: Section 312000.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sanitary Sewer:
   1. Pipe and Fittings: As noted on Civil Drawings and per WSDOT Std. Specs.

B. Cleanouts: As noted on Civil Drawings.

C. Backfill: As noted on Civil Drawings.

D. Bedding Materials: As noted on Civil Drawings.

E. Manholes, Frames and Covers: per Civil Drawings and WSDOT Standard Specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sanitary Sewer:
   1. Grade as noted on Civil Drawings. Extend and connect to septic system as shown.

B. Cleanouts: Extend to grade at each bend of 45 degrees or more and where shown. Set covers in 18 inch by 18 inch by 6 inch thick concrete pad with beveled edges and top flush with finished grade.

3.2 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated on Civil Plans and per WSDOT Std. Specs.

B. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join similar pipe materials per WSDOT Standard Specifications.
2. Join dissimilar pipe materials with nonpressure-type flexible couplings and per WSDOT Standard Specifications.

END OF SECTION
SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pipe and fittings.
   2. Nonpressure transition couplings.
   3. Cleanouts.
   4. Drains.
   5. Manholes.
   6. Catch basins.
   7. Stormwater inlets.
   8. Stormwater detention structures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
   1. Manholes: Include plans, elevations, sections, details, frames, and covers.
   2. Catch basins. Include plans, elevations, sections, details, frames, covers, and grates.
   3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer’s written rigging instructions.

D. Handle catch basins according to manufacturer’s written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage 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 Architect no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Architect’s written permission.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings Per Civil Drawings and WSDOT Std. Specs.

B. PVC Corrugated Pip and Fittings Per Civil Drawings and WSDOT Std. Specs.

C. PVC Solid Wall Storm Sewer Pipe Couplings and Fittings Per Civil Drawings and WSDOT Std. Specs.

2.2 CLEANOUTS

A. PVC Cleanouts, per Civil Drawings and WSDOT Standard Specs.
2.3 MANHOLES
   A. Standard Precast Concrete Manholes per Civil Drawings and WSDOT Standard Specifications.
   B. Manhole Frames and Covers per Civil Drawings and WSDOT Standard Specifications.

2.4 CATCH BASINS
   A. Standard Precast Concrete Catch Basins per Civil Drawings and WSDOT Standard Specifications.
   B. Frames and Grates per Civil Drawings and WSDOT Standard Specifications.

2.5 STORMWATER INLETS
   A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to Civil Drawings and WSDOT Standard Specifications.
   B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to Civil Drawings and WSDOT Standard Specifications.
   C. Frames and Grates per Civil Drawings and WSDOT Standard Specifications.

2.6 PIPE OUTLETS
   A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
   B. Energy Dissipaters per Civil Drawings and WSDOT Std. Specs

PART 3 - EXECUTION

3.1 EARTHWORK
   A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION
   A. Install per Civil Drawings and WSDOT Standard Specifications.
   B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer’s written instructions for use of lubricants, cements, and other installation requirements.
C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure drainage piping according to the following:
   1. Install piping pitched down in direction of flow.
   2. Install piping per WSDOT Standard Specifications.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
   1. Join similar pipe materials per WSDOT Standard Specifications.
   2. Join dissimilar pipe materials with nonpressure-type flexible couplings and per WSDOT Standard Specifications.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from storm pipes to cleanouts at grade where required on the Civil Drawings. Install piping so cleanouts open in direction of flow in storm sewer pipe.

B. Set cleanout frames and covers as shown on the Civil Drawings.

3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated on Civil Plans and per WSDOT Std. Specs.

B. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated on Civil Plans.

B. Set frames and grates to elevations indicated on Civil Plans.

3.7 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct riprap of broken stone, as indicated on Civil Drawings.
B. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

C. Construct energy dissipaters at outlets, as indicated on Civil Drawings.

### 3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to WSDOT Std. Specs.

### 3.9 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

### 3.10 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION