



Spokane HERB Building Cooling Tower Replacement

**Washington State University
Spokane, WA**

Project Manual

Project No. 1152-2020
Issued: 8/27/2020
Washington State University
Facility Services, Capital

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

STRUCTURAL ENGINEERS:

Integrus Architecture
10S Cedar Street
Spokane, WA 99201
509-838-8681

Place Stamp Here

Specification Divisions 03

MECHANICAL ENGINEERS:

MW Consulting Engineers
North 222 Wall Street, Suite 200
Spokane, WA 99201-0813
509-838-9020

Place Stamp Here

Specification Divisions 22-26

ELECTRICAL ENGINEERS:

MW Consulting Engineers
North 222 Wall Street, Suite 200
Spokane, WA 99201-0813
509-838-9020

Place Stamp Here

Specification Divisions 22-26

END OF ARCHITECTURAL / ENGINEERING STAMPS

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END OF SECTION 00 01 10

Washington State University
Spokane HERB Building Cooling Tower Replacement
Spokane, WA

Sealed bids are being requested by the Board of Regents of Washington State University, for the above referenced project.

Project Scope:

The WSU Spokane WSU HERB Cooling Tower Replacement Project will replace the existing cooling tower with two new fluid coolers. Project will include the removal of the existing tower, condenser pumps, piping and foundations. Project will also include all associated concrete foundations, piping, controls, pumps, water treatment system, valving, mechanical/electrical systems and associated fencing replacement required for the installation of the cooling towers and associated mechanical improvements. Contract Substantial Completion shall be achieved by March 12, 2021. Proposals MUST BE based on this Contract Time.

Project Physical address: 655 N. Riverpoint Boulevard, Spokane, WA 99202

Bid Estimate: \$550,000.00 to \$650,000.00

Alternate 1: The installation of all equipment, piping and support pads associated with the sidestream separator and basin sweeper systems. No additional working days shall be added to the Contract Time for this Alternate.

Bids will be received prior to 2:00 p.m.; Tuesday, September 22, 2020 by fax 509-335-9304 or email to contracts@wsu.edu. Proposals will then be publicly opened and read aloud by Zoom <https://wsu.zoom.us/j/93380454845?pwd=ZUlwYlhRbWlhaUk3aDB4RmtHbnMhZz09> or, Phone 253-215-8782 and entering Meeting ID 933 8045 4845; Passcode 328360. Attendance in person is not allowed.

A pre-bid conference for general contractors will be held at 10:00 a.m. on Thursday, September 10, 2020. Attendees may attend by Zoom: <https://wsu.zoom.us/j/95348662731?pwd=SnhEQ2cxNklzOEJJYlAvdnBBNmhYQT09> or, Phone 253-215-8782 and entering Meeting ID 953 4866 2731. Enter Passcode: 885282. Attendance in person is not allowed.

Parking on campus is enforced 24 hours a day, every day. It is bidder's responsibility to obtain parking permits to attend pre-bid meetings, site visits, and bid openings. 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

END OF SECTION 00 11 13

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Refer to the Advertisement for Bids for Project identification, availability of bidding documents, Pre-Bid 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 5 Days before the time of bid opening may not be answered. All issued addenda shall be incorporated into these Contract Documents.
- E. Parking on campus is enforced 24 hours a day, every day. It is bidder's responsibility to obtain parking permits to visit campus. Due to the possibility of parking at multiple locations on campus, bidders are advised to consider obtaining Orange Temporary Permits.
Go to <https://spokane.wsu.edu/facilities/parking/permits/> for more information about parking permits.

1.04 PREBID CONFERENCE

- A. All bidders are encouraged to attend a pre-bid conference. WSU Facilities Services is taking precautions to limit exposure and impacts related to COVID-19. Due to the "Stay Home, Stay Healthy" mandate, pre-bid meetings and bid openings may only be attended via Zoom Video Conference/Phone Conference. Refer to the Advertisement for Bids for the date, time and electronic meeting options.
- B. In order to continue providing secure and effective meetings the University is requiring that Zoom be downloaded and installed via a computer client rather than connecting through a web browser plugin. The computer client can be found here: <https://support.zoom.us/hc/en-us/articles/207373866-Zoom-Installers>

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 5 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. To comply with the Governors "Stay Home, Stay Healthy" mandate bidders must submit their bids in electronic or fax format and the requirement to submit a sealed bid is waived. No other method of bid will be accepted.
 - a. Electronic Bids: Bidders may submit their bid via email to contracts@wsu.edu prior to the bid submission deadline. The emailed bid must include all documents that would have normally been submitted in the sealed envelope, including but not limited to the Form of Proposal and bid bond, in either PDF or Image format.
 - b. Faxed Bids: Bidders may submit their bid via Fax to 509-335-9304 prior to the bid submission deadline. The faxed bid must include all documents that would have normally been submitted in the sealed envelope, including but not limited to the Form of Proposal and bid bond.

- c. The 3 lowest bidders shall mail their original bid and accompanying original bid security shall be mailed and post marked within 72 hours of the bid open, all other bidders may retain their bids. Mail to:

Facilities Services
P.O. Box 641150
100 McCluskey Services Building
Washington State University
Pullman, WA 99164-1150
- 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 Part A 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. 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 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 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.

1.15 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.

1.16 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.

1.17 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. For projects involving 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.
- D. 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.
- E. 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.

- F. 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.
- G. 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.

1.18 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.

1.19 CONTRACT FORMS

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

END OF SECTION 00 21 13

Washington State University
Spokane HERB Building Cooling Tower Replacement
Spokane, 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 "Spokane HERB Building Cooling Tower Replacement" 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 (\$ _____),
including trench-excavation safety provisions if required. The amount of trench-
excavation safety provisions included above is \$ _____,

B. UNIT PRICES – NOT USED

C. ALTERNATES

The Bidder proposes to modify the Base Bid by deleting from, adding to or otherwise modifying the Work as further described by the Contract Documents for the following stipulated sums:

Alternate No. & Description

Alternate No. 1 – Installation of all equipment, piping and support pads associated with the sidestream separator and basin sweeper systems. No additional working days shall be added to the Contract Time for this Alternate.

_____ DOLLARS (\$ _____),

For Alternates, which do not affect the Base Bid, indicate a zero (0) in the space provided for the Alternate.

D. REINSTATEMENT OF BID ALTERNATES

The Bidder agrees that Owner has the right to reinstate any Alternate not incorporated in the original Contract, for the sum originally proposed, provided Owner notifies the Bidder within 60 Days of Notice to Proceed.

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. 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

Spokane HERB Building Cooling Tower Replacement

Agreement between Owner and Contractor (Fixed Contract Sum)

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): MW Consulting Engineers
North 222 Wall Street, Suite 200
Spokane, WA 99201-0813

PROJECT: Spokane HERB Building Cooling Tower Replacement
665 N. Riverpoint Blvd
Spokane, WA 99202

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. It is anticipated that the Notice to Proceed for the Cooling Tower demolition will be issued on October 19, 2020 when the weather

- conditions should allow the existing Cooling Tower to be demolished. This shutdown date will ensure that the existing Cooling Tower may be utilized to maintain temperatures in the Vivarium.
- 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 by March 12, 2021 subject to adjustments as provided in the Contract Documents, and shall achieve Final Completion not later than Twenty (20) 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 Two thousand four hundred seventy-six dollars, and forty-eight cents (\$2,476.48) per Day for each Day beyond the contractual date for Substantial Completion that Substantial Completion is not timely achieved, and subsequently Three hundred sixty dollars, and forty-eight cents (\$360.48) 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:

Alternate No.	Description	Price (\$0.00)
1	The installation of all equipment, piping and support pads associated with the sidestream separator and basin sweeper systems.	

5.3 Unit Prices. Any Unit Prices are as follows:

Description	Units	Price (\$0.00)
None		

Unit Prices as set forth in the Contract Documents are "all in." They include all material, equipment, labor, delivery, installation, and Subcontractor costs, any overhead and profit not included in the fee, and any other costs or expenses in 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:

Allowance	Amount	Included Items
None		

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:

Eric Smith
Project Manager
Facilities Services, Capital
WSU Spokane

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.

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.
- 8.1.2 The General Conditions for Washington State Facility Construction with Washington State University Amendments, and any Supplementary Conditions of the Contract.
- 8.1.3 The Addenda, if any, are as follows:

Number	Date	Pages

- 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)

Joe Kline
Assistant Vice President for
Facilities Services, Capital

(Signature) (Date)

(Printed Name)
(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.

**FOR WASHINGTON STATE FACILITY CONSTRUCTION
WITH WASHINGTON STATE UNIVERSITY AMENDMENTS**

- 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.

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- 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

Time. In case of conflict within the Specifications, provisions in Division 1 shall take precedence over provisions of any other Division. In case of conflict within the Drawings, large scale Drawings shall take precedence over small scale Drawings.

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.

**FOR WASHINGTON STATE FACILITY CONSTRUCTION
WITH WASHINGTON STATE UNIVERSITY AMENDMENTS**

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.

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- 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

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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.

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- 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.

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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

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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

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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

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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 oversight 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

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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.

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- 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

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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

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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.

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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.

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- 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

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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

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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.

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- 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.

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- 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

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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

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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

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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.

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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;

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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.

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- 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; or
 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.

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- 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

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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).

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- 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 within 14 Days shall constitute Contractor's acceptance of the terms of the Unilateral Change Order.

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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

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- 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:

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- (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

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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:

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- (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

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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

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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

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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

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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:

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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.

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- 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.);
 10. Vendors', rental agencies', Subcontractors', and agents' invoices;
 11. Contracts between Contractor and each of its Subcontractors, and all lower-tier Subcontractor contracts and supplier contracts;
 12. Subcontractors' and agents' payment certificates;

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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

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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.

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- 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

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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.

**FOR WASHINGTON STATE FACILITY CONSTRUCTION
WITH WASHINGTON STATE UNIVERSITY AMENDMENTS****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.

END OF SECTION 00 72 00

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. The WSU Spokane WSU HERB Cooling Tower Replacement Project will replace the existing cooling tower with two new fluid coolers. Project will include the removal of the existing tower, condenser pumps, piping and foundations. Project will also include all associated concrete foundations, piping, controls, pumps, water treatment system, valving, mechanical/electrical systems and associated fencing replacement required for the installation of the cooling towers and associated mechanical improvements. Substantial Completion shall be achieved by March 12, 2021. Proposals MUS BE based on this Contract Time.

1.02 SCHEDULE OF ALTERNATES

- A. Without limiting the requirements of the Contract Documents, the Work of the Alternates can be summarized as follows:
 - 1. The installation of all equipment, piping and support pads associated with the sidestream separator and basin sweeper systems. No additional working days shall be added to the Contract Time for this Alternate.

1.03 SCHEDULE OF ALLOWANCES – NOT USED

1.04 SCHEDULE OF UNIT PRICES – NOT USED

- A. Without limiting the requirements of the Contract Documents, the Work of the Unit Prices can be summarized as follows

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. Structural Engineer: Integrus Architecture, Spokane, WA
 - b. Mechanical Engineer: MW Consulting Engineers, Spokane, WA
 - c. Electrical Engineer: MW Consulting Engineers, Spokane, WA

1.06 SPECIAL CONDITIONS

- A. Site Access: The Cooling Tower is access from the HERB Parking Lot. The mechanical room can be accessed from the HERB Loading Dock.
- B. Schedule and Phasing: The Cooling Tower serves the existing vivarium located within the basement of HERB. This facility has ongoing research projects that rely upon the cooling properties that the improvements provide and will be ongoing during construction. It is imperative that the improvements are completed on time to ensure temperatures in the building can be maintained below 68 degrees at all times.

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 is 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/Spokane 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

State of Washington
Department of Labor & Industries
Prevailing Wage Section - Telephone 360-902-5335
PO Box 44540, Olympia, WA 98504-4540

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: 8/27/2020

<u>County</u>	<u>Trade</u>	<u>Job Classification</u>	<u>Wage</u>	<u>Holiday</u>	<u>Overtime</u>	<u>Note</u>	<u>*Risk Class</u>
Spokane	Asbestos Abatement Workers	Journey Level	\$41.04	<u>5D</u>	<u>1H</u>		View
Spokane	Boilermakers	Journey Level	\$69.29	<u>5N</u>	<u>1C</u>		View
Spokane	Brick Mason	Journey Level	\$50.44	<u>5A</u>	<u>1M</u>		View
Spokane	Building Service Employees	Janitor	\$14.90	<u>5Q</u>	<u>1</u>		View
Spokane	Building Service Employees	Shampooer	\$16.61	<u>5Q</u>	<u>1</u>		View
Spokane	Building Service Employees	Waxer	\$16.61	<u>5Q</u>	<u>1</u>		View
Spokane	Building Service Employees	Window Cleaner	\$17.69	<u>5Q</u>	<u>1</u>		View
Spokane	Cabinet Makers (In Shop)	Journey Level	\$14.30		<u>1</u>		View
Spokane	Carpenters	Acoustical Worker	\$47.37	<u>7E</u>	<u>4X</u>	<u>8N</u>	View
Spokane	Carpenters	Bridge, Dock & Wharf Carpenter	\$48.57	<u>7E</u>	<u>4X</u>	<u>8N</u>	View
Spokane	Carpenters	Floor Layer & Floor Finisher	\$47.37	<u>7E</u>	<u>4X</u>	<u>8N</u>	View
Spokane	Carpenters	Form Builder	\$47.37	<u>7E</u>	<u>4X</u>	<u>8N</u>	View
Spokane	Carpenters	General Carpenter	\$47.37	<u>7E</u>	<u>4X</u>	<u>8N</u>	View
Spokane	Carpenters	Heavy Construction Carpenter	\$52.35	<u>7E</u>	<u>4X</u>	<u>9E</u>	View
Spokane	Carpenters	Scaffold/Shoring Erecting & Dismantling	\$52.35	<u>7E</u>	<u>4X</u>	<u>8N</u>	View
Spokane	Cement Masons	Journey Level	\$45.14	<u>7B</u>	<u>1N</u>		View
Spokane	Divers & Tenders	Assistant Tender	\$54.54	<u>7E</u>	<u>4X</u>		View
Spokane	Divers & Tenders	Dive Supervisors	\$100.84	<u>7E</u>	<u>4X</u>		View
Spokane	Divers & Tenders	Diver	\$99.34	<u>7E</u>	<u>4X</u>	<u>8V</u>	View
Spokane	Divers & Tenders	Diver on Standby	\$58.11	<u>7E</u>	<u>4X</u>		View
Spokane	Divers & Tenders	Diver Tender	\$57.11	<u>7E</u>	<u>4X</u>		View
Spokane	Divers & Tenders	Diving Master	\$67.86	<u>7E</u>	<u>4X</u>		View
Spokane	Divers & Tenders	Manifold Operator	\$57.11	<u>7E</u>	<u>4X</u>		View
Spokane	Divers & Tenders	Manifold Operator Mixed Gas	\$61.11	<u>7E</u>	<u>4X</u>		View

Spokane	Divers & Tenders	Remote Operated Vehicle Operator	\$57.11	<u>7E</u>	<u>4X</u>		View
Spokane	Divers & Tenders	Remote Operated Vehicle Tender/Technician	\$54.54	<u>7E</u>	<u>4X</u>		View
Spokane	Divers & Tenders	Surface RCV & ROV Operator	\$57.11	<u>7E</u>	<u>4X</u>		View
Spokane	Dredge Workers	Assistant Engineer	\$56.44	<u>5D</u>	<u>3F</u>		View
Spokane	Dredge Workers	Assistant Mate (Deckhand)	\$56.00	<u>5D</u>	<u>3F</u>		View
Spokane	Dredge Workers	Boatmen	\$56.44	<u>5D</u>	<u>3F</u>		View
Spokane	Dredge Workers	Engineer Welder	\$57.51	<u>5D</u>	<u>3F</u>		View
Spokane	Dredge Workers	Leverman, Hydraulic	\$58.67	<u>5D</u>	<u>3F</u>		View
Spokane	Dredge Workers	Mates	\$56.44	<u>5D</u>	<u>3F</u>		View
Spokane	Dredge Workers	Oiler	\$56.00	<u>5D</u>	<u>3F</u>		View
Spokane	Drywall Applicator	Journey Level	\$47.37	<u>7E</u>	<u>4X</u>	<u>8N</u>	View
Spokane	Drywall Tapers	Journey Level	\$42.54	<u>7E</u>	<u>1P</u>		View
Spokane	Electrical Fixture Maintenance Workers	Journey Level	\$30.89		<u>1</u>		View
Spokane	Electricians - Inside	Journeyman	\$55.71	<u>7G</u>	<u>1E</u>		View
Spokane	Electricians - Motor Shop	Craftsman	\$15.37		<u>1</u>		View
Spokane	Electricians - Motor Shop	Journey Level	\$14.69		<u>1</u>		View
Spokane	Electricians - Powerline Construction	Cable Splicer	\$82.39	<u>5A</u>	<u>4D</u>		View
Spokane	Electricians - Powerline Construction	Certified Line Welder	\$75.64	<u>5A</u>	<u>4D</u>		View
Spokane	Electricians - Powerline Construction	Groundperson	\$49.17	<u>5A</u>	<u>4D</u>		View
Spokane	Electricians - Powerline Construction	Heavy Line Equipment Operator	\$75.64	<u>5A</u>	<u>4D</u>		View
Spokane	Electricians - Powerline Construction	Journey Level Lineperson	\$75.64	<u>5A</u>	<u>4D</u>		View
Spokane	Electricians - Powerline Construction	Line Equipment Operator	\$64.54	<u>5A</u>	<u>4D</u>		View
Spokane	Electricians - Powerline Construction	Meter Installer	\$49.17	<u>5A</u>	<u>4D</u>	<u>8W</u>	View
Spokane	Electricians - Powerline Construction	Pole Sprayer	\$75.64	<u>5A</u>	<u>4D</u>		View
Spokane	Electricians - Powerline Construction	Powderperson	\$56.49	<u>5A</u>	<u>4D</u>		View
Spokane	Electronic Technicians	Journey Level	\$44.50	<u>5I</u>	<u>1B</u>		View
Spokane	Elevator Constructors	Mechanic	\$97.31	<u>7D</u>	<u>4A</u>		View
Spokane	Elevator Constructors	Mechanic In Charge	\$105.06	<u>7D</u>	<u>4A</u>		View
Spokane	Fabricated Precast Concrete Products	Journey Level	\$20.23		<u>1</u>		View
Spokane	Fabricated Precast Concrete Products	Journey Level - In-Factory Work Only	\$20.23		<u>1</u>		View
Spokane	Fence Erectors	Fence Erector	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Fence Erectors	Fence Erector	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Flaggers	Journey Level	\$38.94	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Glaziers	Journey Level	\$31.59	<u>7L</u>	<u>4L</u>		View

Spokane	Heat & Frost Insulators And Asbestos Workers	Journey Level	\$51.04	<u>5K</u>	<u>1U</u>		View
Spokane	Heating Equipment Mechanics	Journey Level	\$56.61	<u>6Z</u>	<u>1B</u>		View
Spokane	Hod Carriers & Mason Tenders	Journey Level	\$41.39	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Industrial Power Vacuum Cleaner	Journey Level	\$13.50		<u>1</u>		View
Spokane	Inland Boatmen	Journey Level	\$13.50		<u>1</u>		View
Spokane	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Cleaner Operator, Foamer Operator	\$13.50		<u>1</u>		View
Spokane	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Grout Truck Operator	\$13.50		<u>1</u>		View
Spokane	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Head Operator	\$13.50		<u>1</u>		View
Spokane	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Technician	\$13.50		<u>1</u>		View
Spokane	Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Tv Truck Operator	\$13.50		<u>1</u>		View
Spokane	Insulation Applicators	Journey Level	\$47.37	<u>7E</u>	<u>4X</u>	<u>8N</u>	View
Spokane	Ironworkers	Journeyman	\$63.06	<u>7N</u>	<u>1O</u>		View
Spokane	Laborers	Air And Hydraulic Track Drill	\$41.58	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Asphalt Raker	\$41.58	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Asphalt Roller, Walking	\$41.31	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Brick Pavers	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Brush Hog Feeder	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Brush Machine	\$41.58	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Caisson Worker, Free Air	\$41.58	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Carpenter Tender	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Cement Finisher Tender	\$41.31	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Cement Handler	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Chain Saw Operator & Faller	\$41.58	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Clean-up Laborer	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Compaction Equipment	\$41.31	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Concrete Crewman	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Concrete Saw, Walking	\$41.31	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Concrete Signalman	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Concrete Stack	\$41.58	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Confined Space Attendant	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Crusher Feeder	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Demolition	\$41.04	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View
Spokane	Laborers	Demolition Torch	\$41.31	<u>7B</u>	<u>1M</u>	<u>8Z</u>	View

Spokane	Laborers	Dope Pot Fireman, Non-mechanical	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Driller Helper (when Required To Move & Position Machine)	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Drills With Dual Masts	\$41.86	7B	1M	8Z	View
Spokane	Laborers	Dry Stack Walls	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Dumpman	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Erosion Control Laborer	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Final Detail Cleanup (i.e, Dusting, Vacuuming, Window Cleaning; Not Construction Debris Cleanup)	\$38.94	7B	1M	8Z	View
Spokane	Laborers	Firewatch	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Form Cleaning Machine Feeder, Stacker	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Form Setter, Paving	\$41.31	7B	1M	8Z	View
Spokane	Laborers	General Laborer	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Grade Checker	\$43.57	7B	1M	8Z	View
Spokane	Laborers	Grout Machine Header Tender	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Guard Rail	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Gunite	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Hazardous Waste Worker (level A)	\$41.86	7B	1M	8Z	View
Spokane	Laborers	Hazardous Waste Worker (level B)	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Hazardous Waste Worker (level C)	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Hazardous Waste Worker (level D)	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Hdpe Or Similar Liner Installer	\$41.04	7B	1M	8Z	View
Spokane	Laborers	High Scaler	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Jackhammer Operator Miner, Class "b"	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Laser Beam Operator	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Miner, Class "a"	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Miner, Class "c"	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Miner, Class "d"	\$41.86	7B	1M	8Z	View
Spokane	Laborers	Monitor Operator, Air Track Or Similar Mounting	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Mortar Mixer	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Nipper	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Nozzleman	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Nozzleman, Water (to Include Fire Hose), Air Or Steam	\$41.31	7B	1M	8Z	View

Spokane	Laborers	Pavement Breaker, 90 Lbs. & Over	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Pavement Breaker, Under 90 Lbs.	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Pipelayer	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Pipelayer, Corrugated Metal Culvert And Multi-plate.	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Pipewrapper	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Plasterer Tenders	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Pot Tender	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Powderman	\$43.23	7B	1M	8Z	View
Spokane	Laborers	Powderman Helper	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Power Buggy Operator	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Power Tool Operator, Gas, Electric, Pneumatic	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Railroad Equipment, Power Driven, Except Dual Mobile	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Railroad Power Spiker Or Puller, Dual Mobile	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Remote Equipment Operator	\$41.86	7B	1M	8Z	View
Spokane	Laborers	Remote Equipment Operator (i.e Compaction And Demolition)	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Rigger/signal Person	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Riprap Person	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Rodder & Spreader	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Sandblast Tailhoseman	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Scaffold Erector, Wood Or Steel	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Stake Jumper	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Structural Mover	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Tailhoseman (water Nozzle)	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Timber Bucker & Faller (by Hand)	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Track Laborer (rr)	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Traffic Control Laborer	\$38.94	7B	1M	9D	View
Spokane	Laborers	Traffic Control Supervisor	\$39.94	7B	1M	9E	View
Spokane	Laborers	Trencher, Shawnee	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Trenchless Technology Technician	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Truck Loader	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Tugger Operator	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Vibrators, All	\$41.58	7B	1M	8Z	View
Spokane	Laborers	Wagon Drills	\$41.31	7B	1M	8Z	View
Spokane	Laborers	Water Pipe Liner	\$41.31	7B	1M	8Z	View

Spokane	Laborers	Welder, Electrical, Manual Or Automatic (hdpe Or Similar Pipe And Liner)	\$41.86	7B	1M	8Z	View
Spokane	Laborers	Well-point Person	\$41.04	7B	1M	8Z	View
Spokane	Laborers	Wheelbarrow, Power Driven	\$41.31	7B	1M	8Z	View
Spokane	Laborers - Underground Sewer & Water	General Laborer & Topman	\$41.04	7B	1M	8Z	View
Spokane	Laborers - Underground Sewer & Water	Pipe Layer	\$41.58	7B	1M	8Z	View
Spokane	Landscape Construction	Landscape Laborer	\$38.94	7B	1M	9D	View
Spokane	Landscape Construction	Landscape Operator	\$46.85	7B	4W	9A	View
Spokane	Landscape Maintenance	Groundskeeper	\$13.50		1		View
Spokane	Lathers	Journey Level	\$47.37	7E	4X	8N	View
Spokane	Marble Setters	Journey Level	\$50.44	5A	1M		View
Spokane	Metal Fabrication (In Shop)	Fitter	\$13.50		1		View
Spokane	Metal Fabrication (In Shop)	Laborer	\$13.50		1		View
Spokane	Metal Fabrication (In Shop)	Machine Operator	\$13.50		1		View
Spokane	Metal Fabrication (In Shop)	Painter	\$13.50		1		View
Spokane	Metal Fabrication (In Shop)	Welder	\$13.50		1		View
Spokane	Millwright	Journey Level	\$66.83	7E	4X	8N	View
Spokane	Modular Buildings	Journey Level	\$13.50		1		View
Spokane	Painters	Commercial Painter	\$36.87	6Z	1W		View
Spokane	Painters	Industrial Painter	\$45.37	6Z	1W	9D	View
Spokane	Pile Driver	General Pile Driver	\$48.57	7E	4X	8N	View
Spokane	Pile Driver	Heavy Construction Pile Driver	\$53.54	7E	4X	9E	View
Spokane	Plasterers	Journey Level	\$42.88	7K	1N		View
Spokane	Playground & Park Equipment Installers	Journey Level	\$13.50		1		View
Spokane	Plumbers & Pipefitters	Journey Level	\$65.35	7E	1J		View
Spokane	Power Equipment Operators	A-frame Truck (2 Or More Drums)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	A-frame Truck (single Drum)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Asphalt Plant Operator	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Assistant Plant Operator, Fireman Or Pugmixer (asphalt)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Assistant Refrigeration Plant & Chiller Operator (over 1000 Ton)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Assistant Refrigeration Plant (under 1000 Ton)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Automatic Subgrader (ditches & Trimmers)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Backfillers (cleveland & Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators		\$47.01	7B	4W	9A	View

		Backhoe & Hoe Ram (under 3/4 Yd.)					
Spokane	Power Equipment Operators	Backhoe (45,000 Gw & Under)	\$47.01	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Backhoe (45,000 Gw To 110,000 Gw)	\$47.29	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Backhoe (over 110,000 Gw)	\$47.56	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Backhoes & Hoe Ram (3 Yds & Over)	\$47.56	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Backhoes & Hoe Ram (3/4 Yd. To 3 Yd.)	\$47.29	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Bagley Or Stationary Scraper	\$46.08	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Batch & Wet Mix Operator (multiple Units, 2 & Incl. 4)	\$47.29	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Batch Plant & Wet Mix Operator, Single Unit (concrete)	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Batch Plant (over 4 Units)	\$47.29	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Belt Finishing Machine	\$46.08	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Belt Loader (kocal Or Similar)	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Belt-crete Conveyors With Power Pack Or Similar	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Bending Machine	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Bit Grinders	\$45.76	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Blade (finish & Bluetop), Automatic, Cmi, Abc, Finish Athey & Huber & Similar When Used As Automatic	\$47.56	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Blade Operator (motor Patrol & Attachments)	\$47.29	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Blower Operator (cement)	\$46.08	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Boat Operator	\$45.76	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Bob Cat (skid Steer)	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Bolt Threading Machine	\$45.76	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Boom Cats (side)	\$47.29	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Boring Machine (earth)	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Boring Machine (Rock Under 8 inch Bit - Quarry Master, Joy Or Similar)	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Boring Machine (Rock Under 8" Bit - Quarry Master, Joy Or Similar)	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators	Boring Machine (rock Under 8" Bit) (quarry Master, Joy Or Similar)	\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View
Spokane	Power Equipment Operators		\$46.69	<u>7B</u>	<u>4W</u>	<u>9A</u>	View

		Bump Cutter (wayne, Saginaw Or Similar)					
Spokane	Power Equipment Operators	Cableway Controller (dispatcher)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Cableway Operators	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Canal Lining Machine (concrete)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Carrydeck & Boom Truck (under 25 Tons)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Cement Hog	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Chipper (without Crane) Cleaning & Doping Machine (pipeline)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Clamshell, Dragline	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators	Compactor (self-propelled With Blade)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Compressor (2000 Cfm Or Over, 2 Or More, Gas Diesel Or Electric Power)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Compressors (under 2000 Cfm, Gas, Diesel Or Electric Power)	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Concrete Cleaning / Decontamination Machine Operator	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Concrete Pump Boon Truck	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Concrete Pumps (squeeze-crete, Flow-crete, Whitman & Similar)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Concrete Saw (multiple Cut)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Concrete Slip Form Paver	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Conveyor Aggregate Delivery Systems (c.a.d.)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Crane Oiler- Driver (cdl Required) & Cable Tender, Mucking Machine	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Cranes (100 to 299 Tons) And All Climbing, Overhead, Rail & Tower. All Attachments Incl.	\$49.16	7B	4W	9A	View
Spokane	Power Equipment Operators	Cranes (25 Tons & Under), All Attachments Incl. Clamshell, Dragline	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Cranes (25 Tons To And Including 45 Tons), All Attachments Incl. Clamshell, Dragline	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Cranes (300 Tons and Over) And All Climbing,	\$49.66	7B	4W	9A	View

		Overhead, Rail & Tower. All Attachments Incl.					
Spokane	Power Equipment Operators	Cranes (45 Tons To 85 Tons), All Attachments Incl. Clamshell And Dragline	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Cranes (86 to 99 Tons) And All Climbing, Overhead, Rail & Tower. All Attachments Incl.	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators	Crusher Feeder	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Crusher, Grizzle & Screening Plant Operator	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Curb Extruder (asphalt Or Concrete)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Deck Engineer	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Deck Hand	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Derricks & Stifflegs (65 Tons & Over)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Derricks & Stifflegs (under 65 Tons)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Distributor Leverman	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Ditch Witch Or Similar	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Dope Pots (power Agitated)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Dozer / Tractor (up To D-6 Or Equivalent) And Traxcavator	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Dozer / Tractors (d-6 & Equivalent & Over)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Dozer, 834 R/t & Similar	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Drill Doctor	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Driller Licensed	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators	Drillers Helper	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Drilling Equipment (8 inch Bit & Over - Robbins, Reverse Circulation & Similar)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Drilling Equipment (8" Bit & Over - Robbins, Reverse Circulation & Similar)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Drilling Equipment (8" Bit & Over) (robbins, Reverse Circulation & Similar)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Drills (churn, Core, Calyx Or Diamond)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Elevating Belt (holland Type)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Elevating Belt-type Loader (euclid, Barber Green & Similar)	\$46.69	7B	4W	9A	View

Spokane	Power Equipment Operators	Elevating Grader-type Loader (dumorf, Adams Or Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Elevator Hoisting Materials	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Equipment Serviceman, Greaser & Oiler	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Fireman & Heater Tender	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Fork Lift Or Lumber Stacker, Hydra-life & Similar	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Generator Plant Engineers (diesel Or Electric)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Gin Trucks (pipeline)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Grade Checker	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Gunit Combination Mixer & Compressor	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	H.d. Mechanic	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	H.d. Welder	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Heavy Equipment Robotics Operator	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Helicopter Pilot	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators	Helper, Mechanic Or Welder, H.D	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Hoe Ram	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Hoist (2 Or More Drums Or Tower Hoist)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Hoist, Single Drum	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Hydraulic Platform Trailers (goldhofer, Shaurerly And Similar)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Hydro-seeder, Mulcher, Nozzleman	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Lime Batch Tank Operator (recycle Train)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Lime Brain Operator (recycle Train)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Loader (360 Degrees Revolving Koehring Scooper Or Similar)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Loader Operator (front-end & Overhead, 4 Yds. Incl. 8 Yds.)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Loaders (bucket Elevators And Conveyors)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Loaders (overhead & Front-end, Over 8 Yds. To 10 Yds.)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Loaders (overhead & Front-end, Under 4 Yds.. R/t)	\$46.85	7B	4W	9A	View

Spokane	Power Equipment Operators	Loaders (overhead And Front-end, 10 Yds. & Over)	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators	Locomotive Engineer	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Longitudinal Float	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Master Environmental Maintenance Technician	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Mixer (portable - Concrete)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Mixermobile	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Mobile Crusher Operator (recycle Train)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Mucking Machine	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Multiple Dozer Units With Single Blade	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Pavement Breaker, Hydra-hammer & Similar	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Paving (dual Drum)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Paving Machine (asphalt And Concrete)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Piledriving Engineers	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Plant Oiler	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Posthole Auger Or Punch	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Power Broom	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Pump (grout Or Jet)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Pumpman	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Quad-track Or Similar Equipment	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Railroad Ballast Regulation Operator (self-propelled)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Railroad Power Tamper Operator (self-propelled)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Railroad Tamper Jack Operator (self-propelled)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Railroad Track Liner Operator (self-propelled)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Refrigeration Plant Engineer (1000 Tons & Over)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Refrigeration Plant Engineer (under 1000 Ton)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Rollerman (finishing Asphalt Pavement)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Rollers, All Types On Subgrade, Including Seal And Chip Coating (farm Type, Case, John Deere And Similar, or Compacting Vibrator), Except When Pulled B	\$45.76	7B	4W	9A	View

Spokane	Power Equipment Operators	Roto Mill (pavement Grinder)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Rotomill Groundsman	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Rubber-tired Scrapers (multiple Engine With Three Or More Scrapers)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Rubber-tired Skidders (r/t With Or Without Attachments)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Scrapers, All, Rubber-tired	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Screed Operator	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Shovels (3 Yds. & Over)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Shovels (under 3 Yds.)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Signalman (whirleys, Highline, Hammerheads Or Similar)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators	Soil Stabilizer (p & H Or Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Spray Curing Machine (concrete)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Spreader Box (self-propelled)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Spreader Machine	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Steam Cleaner	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Straddle Buggy (ross & Similar On Construction Job Only)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Surface Heater & Planer Machine	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Tractor (farm Type R/t With Attachments, Except Backhoe)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Traverse Finish Machine	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Trenching Machines (7 Ft. Depth & Over)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Trenching Machines (under 7 Ft. Depth Capacity)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Tug Boat Operator	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators	Tugger Operator	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators	Turnhead (with Re-screening)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Turnhead Operator	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators	Ultra High Pressure Waterjet Cutting Tool System Operator, (30,000 Psi)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators	Vactor Guzzler, Super Sucker	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators		\$47.56	7B	4W	9A	View

		Vacuum Blasting Machine Operator					
Spokane	Power Equipment Operators	Vacuum Drill (reverse Circulation Drill Under 8" Bit)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators	Welding Machine	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators	Whirleys & Hammerheads, All	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	A-frame Truck (2 Or More Drums)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	A-frame Truck (single Drum)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Asphalt Plant Operator	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Assistant Plant Operator, Fireman Or Pugmixer (asphalt)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Assistant Refrigeration Plant & Chiller Operator (over 1000 Ton)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Assistant Refrigeration Plant (under 1000 Ton)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Automatic Subgrader (ditches & Trimmers)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Backfillers (cleveland & Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Backhoe & Hoe Ram (under 3/4 Yd.)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Backhoe (45,000 Gw & Under)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Backhoe (45,000 Gw To 110,000 Gw)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Backhoe (over 110,000 Gw)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Backhoes & Hoe Ram (3 Yds & Over)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Backhoes & Hoe Ram (3/4 Yd. To 3 Yd.)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Bagley Or Stationary Scraper	\$46.08	7B	4W	9A	View

Spokane	Power Equipment Operators- Underground Sewer & Water	Batch & Wet Mix Operator (multiple Units, 2 & Incl. 4)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Batch Plant & Wet Mix Operator, Single Unit (concrete)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Batch Plant (over 4 Units)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Belt Finishing Machine	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Belt Loader (kocal Or Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Belt-crete Conveyors With Power Pack Or Similar	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Bending Machine	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Bit Grinders	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Blade (finish & Bluetop), Automatic, Cmi, Abc, Finish Athey & Huber & Similar When Used As Automatic	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Blade Operator (motor Patrol & Attachments)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Blower Operator (cement)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Boat Operator	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Bob Cat (skid Steer)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Bolt Threading Machine	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Boom Cats (side)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Boring Machine (earth)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Boring Machine (Rock Under 8 inch Bit - Quarry Master, Joy Or Similar)	\$46.69	7B	4W	9A	View

Spokane	Power Equipment Operators- Underground Sewer & Water	Boring Machine (Rock Under 8" Bit - Quarry Master, Joy Or Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Boring Machine (rock Under 8" Bit) (quarry Master, Joy Or Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Bump Cutter (wayne, Saginaw Or Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cableway Controller (dispatcher)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cableway Operators	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Canal Lining Machine (concrete)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Carrydeck & Boom Truck (under 25 Tons)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cement Hog	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Chipper (without Crane) Cleaning & Doping Machine (pipeline)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Clamshell, Dragline	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Compactor (self-propelled With Blade)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Compressor (2000 Cfm Or Over, 2 Or More, Gas Diesel Or Electric Power)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Compressors (under 2000 Cfm, Gas, Diesel Or Electric Power)	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Concrete Cleaning / Decontamination Machine Operator	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Concrete Pump Boon Truck	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Concrete Pumps (squeeze-crete, Flow-crete, Whitman & Similar)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Concrete Saw (multiple Cut)	\$46.08	7B	4W	9A	View
Spokane		Concrete Slip Form Paver	\$47.29	7B	4W	9A	View

	Power Equipment Operators- Underground Sewer & Water						
Spokane	Power Equipment Operators- Underground Sewer & Water	Conveyor Aggregate Delivery Systems (c.a.d.)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Crane Oiler- Driver (cdl Required) & Cable Tender, Mucking Machine	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cranes (100 to 299 Tons) And All Climbing, Overhead, Rail & Tower. All Attachments Incl.	\$49.16	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cranes (25 Tons & Under), All Attachments Incl. Clamshell, Dragline	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cranes (25 Tons To And Including 45 Tons), All Attachments Incl. Clamshell, Dragline	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cranes (300 Tons and Over) And All Climbing, Overhead, Rail & Tower. All Attachments Incl.	\$49.66	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cranes (45 Tons To 85 Tons), All Attachments Incl. Clamshell And Dragline	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Cranes (86 to 99 Tons) And All Climbing, Overhead, Rail & Tower. All Attachments Incl.	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Crusher Feeder	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Crusher, Grizzle & Screening Plant Operator	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Curb Extruder (asphalt Or Concrete)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Deck Engineer	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Deck Hand	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Derricks & Stifflegs (65 Tons & Over)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Derricks & Stifflegs (under 65 Tons)	\$47.01	7B	4W	9A	View
Spokane		Distributor Leverman	\$46.08	7B	4W	9A	View

	Power Equipment Operators- Underground Sewer & Water						
Spokane	Power Equipment Operators- Underground Sewer & Water	Ditch Witch Or Similar	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Dope Pots (power Agitated	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Dozer / Tractor (up To D-6 Or Equivalent) And Traxcavator	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Dozer / Tractors (d-6 & Equivalent & Over)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Dozer, 834 R/t & Similar	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Drill Doctor	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Driller Licensed	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Drillers Helper	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Drilling Equipment (8 inch Bit & Over - Robbins, Reverse Circulation & Similar)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Drilling Equipment (8" Bit & Over - Robbins, Reverse Circulation & Similar)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Drilling Equipment (8" Bit & Over) (robbins, Reverse Circulation & Similar)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Drills (churn, Core, Calyx Or Diamond)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Elevating Belt (holland Type)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Elevating Belt-type Loader (euclid, Barber Green & Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Elevating Grader-type Loader (dumor, Adams Or Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Elevator Hoisting Materials	\$46.08	7B	4W	9A	View
Spokane			\$46.85	7B	4W	9A	View

	Power Equipment Operators- Underground Sewer & Water	Equipment Serviceman, Greaser & Oiler					
Spokane	Power Equipment Operators- Underground Sewer & Water	Fireman & Heater Tender	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Fork Lift Or Lumber Stack, Hydra-life & Similar	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Generator Plant Engineers (diesel Or Electric)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Gin Trucks (pipeline)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Grade Checker	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Gunit Combination Mixer & Compressor	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	H.d. Mechanic	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	H.d. Welder	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Heavy Equipment Robotics Operator	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Helicopter Pilot	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Helper, Mechanic Or Welder, H.D	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Hoe Ram	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Hoist (2 Or More Drums Or Tower Hoist)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Hoist, Single Drum	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Hydraulic Platform Trailers (goldhofer, Shaurerly And Similar)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Hydro-seeder, Mulcher, Nozzleman	\$45.76	7B	4W	9A	View
Spokane		Lime Batch Tank Operator (recycle Train)	\$47.29	7B	4W	9A	View

	Power Equipment Operators- Underground Sewer & Water						
Spokane	Power Equipment Operators- Underground Sewer & Water	Lime Brain Operator (recycle Train)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Loader (360 Degrees Revolving Koehring Scooper Or Similar)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Loader Operator (front-end & Overhead, 4 Yds. Incl. 8 Yds.)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Loaders (bucket Elevators And Conveyors)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Loaders (overhead & Front-end, Over 8 Yds. To 10 Yds.)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Loaders (overhead & Front-end, Under 4 Yds.. R/t)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Loaders (overhead And Front-end, 10 Yds. & Over)	\$48.66	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Locomotive Engineer	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Longitudinal Float	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Master Environmental Maintenance Technician	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Mixer (portable - Concrete)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Mixermobile	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Mobile Crusher Operator (recycle Train)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Mucking Machine	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Multiple Dozer Units With Single Blade	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Pavement Breaker, Hydra-hammer & Similar	\$46.08	7B	4W	9A	View
Spokane		Paving (dual Drum)	\$47.01	7B	4W	9A	View

	Power Equipment Operators- Underground Sewer & Water						
Spokane	Power Equipment Operators- Underground Sewer & Water	Paving Machine (asphalt And Concrete)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Piledriving Engineers	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Plant Oiler	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Posthole Auger Or Punch	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Power Broom	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Pump (grout Or Jet)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Pumpman	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Quad-track Or Similar Equipment	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Railroad Ballast Regulation Operator (self-propelled)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Railroad Power Tamper Operator (self-propelled)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Railroad Tamper Jack Operator (self-propelled)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Railroad Track Liner Operator (self-propelled)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Refrigeration Plant Engineer (1000 Tons & Over)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Refrigeration Plant Engineer (under 1000 Ton)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Rollerman (finishing Asphalt Pavement)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Rollers, All Types On Subgrade, Including Seal And Chip Coating (farm Type, Case, John Deere And Similar, or Compacting	\$45.76	7B	4W	9A	View

		Vibrator), Except When Pulled B					
Spokane	Power Equipment Operators- Underground Sewer & Water	Roto Mill (pavement Grinder)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Rotomill Groundsman	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Rubber-tired Scrapers (multiple Engine With Three Or More Scrapers)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Rubber-tired Skidders (r/t With Or Without Attachments)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Scrapers, All, Rubber-tired	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Screed Operator	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Shovels (3 Yds. & Over)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Shovels (under 3 Yds.)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Signalman (whirleys, Highline, Hammerheads Or Similar)	\$47.01	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Soil Stabilizer (p & H Or Similar)	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Spray Curing Machine (concrete)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Spreader Box (self-propelled)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Spreader Machine	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Steam Cleaner	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Straddle Buggy (ross & Similar On Construction Job Only)	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Surface Heater & Planer Machine	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Tractor (farm Type R/t With Attachments, Except Backhoe)	\$46.08	7B	4W	9A	View

Spokane	Power Equipment Operators- Underground Sewer & Water	Traverse Finish Machine	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Trenching Machines (7 Ft. Depth & Over)	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Trenching Machines (under 7 Ft. Depth Capacity)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Tug Boat Operator	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Tugger Operator	\$46.08	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Turnhead (with Re-screening)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Turnhead Operator	\$46.69	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Ultra High Pressure Waterjet Cutting Tool System Operator, (30,000 Psi)	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Vactor Guzzler, Super Sucker	\$47.29	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Vacuum Blasting Machine Operator	\$47.56	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Vacuum Drill (reverse Circulation Drill Under 8" Bit)	\$46.85	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Welding Machine	\$45.76	7B	4W	9A	View
Spokane	Power Equipment Operators- Underground Sewer & Water	Whirleys & Hammerheads, All	\$47.56	7B	4W	9A	View
Spokane	Power Line Clearance Tree Trimmers	Journey Level In Charge	\$53.10	5A	4A		View
Spokane	Power Line Clearance Tree Trimmers	Spray Person	\$50.40	5A	4A		View
Spokane	Power Line Clearance Tree Trimmers	Tree Equipment Operator	\$53.10	5A	4A		View
Spokane	Power Line Clearance Tree Trimmers	Tree Trimmer	\$47.48	5A	4A		View
Spokane	Power Line Clearance Tree Trimmers	Tree Trimmer Groundperson	\$36.10	5A	4A		View
Spokane	Refrigeration & Air Conditioning Mechanics	Journey Level	\$59.25	7E	1J		View
Spokane	Residential Brick Mason	Journey Level	\$22.73		1		View

Spokane	Residential Carpenters	Journey Level	\$21.09		<u>1</u>	View
Spokane	Residential Cement Masons	Journey Level	\$30.58		<u>1</u>	View
Spokane	Residential Drywall Applicators	Journey Level	\$22.73		<u>1</u>	View
Spokane	Residential Drywall Tapers	Journey Level	\$22.73		<u>1</u>	View
Spokane	Residential Electricians	Journey Level	\$31.45	<u>5I</u>	<u>1E</u>	View
Spokane	Residential Glaziers	Journey Level	\$19.64		<u>1</u>	View
Spokane	Residential Insulation Applicators	Journey Level	\$14.86		<u>1</u>	View
Spokane	Residential Laborers	Journey Level	\$18.46		<u>1</u>	View
Spokane	Residential Marble Setters	Journey Level	\$50.44	<u>5A</u>	<u>1M</u>	View
Spokane	Residential Painters	Journey Level	\$17.64		<u>1</u>	View
Spokane	Residential Plumbers & Pipefitters	Journey Level	\$21.78		<u>1</u>	View
Spokane	Residential Refrigeration & Air Conditioning Mechanics	Journey Level	\$21.30		<u>1</u>	View
Spokane	Residential Sheet Metal Workers	Journey Level (Field or Shop)	\$56.61	<u>5I</u>	<u>1B</u>	View
Spokane	Residential Soft Floor Layers	Journey Level	\$17.05		<u>1</u>	View
Spokane	Residential Sprinkler Fitters (Fire Protection)	Journey Level	\$14.86		<u>1</u>	View
Spokane	Residential Stone Masons	Journey Level	\$50.44	<u>5A</u>	<u>1M</u>	View
Spokane	Residential Terrazzo Workers	Journey Level	\$20.61		<u>1</u>	View
Spokane	Residential Terrazzo/Tile Finishers	Journey Level	\$25.58		<u>1</u>	View
Spokane	Residential Tile Setters	Journey Level	\$20.61		<u>1</u>	View
Spokane	Roofers	Journey Level	\$41.09	<u>5I</u>	<u>1R</u>	View
Spokane	Roofers	Using Irritable Bituminous Materials	\$43.09	<u>5I</u>	<u>1R</u>	View
Spokane	Sheet Metal Workers	Journey Level (Field or Shop)	\$56.61	<u>6Z</u>	<u>1B</u>	View
Spokane	Sign Makers & Installers (Electrical)	Journey Level	\$13.91		<u>1</u>	View
Spokane	Sign Makers & Installers (Non-Electrical)	Sign Installer	\$19.12		<u>1</u>	View
Spokane	Sign Makers & Installers (Non-Electrical)	Sign Maker	\$15.00		<u>1</u>	View
Spokane	Soft Floor Layers	Journey Level	\$51.07	<u>5A</u>	<u>3J</u>	View
Spokane	Solar Controls For Windows	Journey Level	\$13.50		<u>1</u>	View
Spokane	Sprinkler Fitters (Fire Protection)	Journey Level	\$58.99	<u>7J</u>	<u>1R</u>	View
Spokane	Stage Rigging Mechanics (Non Structural)	Journey Level	\$13.50		<u>1</u>	View
Spokane	Stone Masons	Journey Level	\$50.44	<u>5A</u>	<u>1M</u>	View
Spokane	Street And Parking Lot Sweeper Workers	Journey Level	\$20.47		<u>1</u>	View
Spokane	Surveyors	All Classifications	\$19.84	<u>0</u>	<u>1</u>	View

Spokane	Telecommunication Technicians	Journey Level	\$44.50	5I	1B		View
Spokane	Telephone Line Construction - Outside	Cable Splicer	\$41.81	5A	2B		View
Spokane	Telephone Line Construction - Outside	Hole Digger/Ground Person	\$23.53	5A	2B		View
Spokane	Telephone Line Construction - Outside	Installer (Repairer)	\$40.09	5A	2B		View
Spokane	Telephone Line Construction - Outside	Special Apparatus Installer I	\$41.81	5A	2B		View
Spokane	Telephone Line Construction - Outside	Special Apparatus Installer II	\$40.99	5A	2B		View
Spokane	Telephone Line Construction - Outside	Telephone Equipment Operator (Heavy)	\$41.81	5A	2B		View
Spokane	Telephone Line Construction - Outside	Telephone Equipment Operator (Light)	\$38.92	5A	2B		View
Spokane	Telephone Line Construction - Outside	Telephone Lineperson	\$38.92	5A	2B		View
Spokane	Telephone Line Construction - Outside	Television Groundperson	\$22.32	5A	2B		View
Spokane	Telephone Line Construction - Outside	Television Lineperson/Installer	\$29.60	5A	2B		View
Spokane	Telephone Line Construction - Outside	Television System Technician	\$35.20	5A	2B		View
Spokane	Telephone Line Construction - Outside	Television Technician	\$31.67	5A	2B		View
Spokane	Telephone Line Construction - Outside	Tree Trimmer	\$38.92	5A	2B		View
Spokane	Terrazzo Workers	Journey Level	\$43.61	5A	1M		View
Spokane	Tile Setters	Journey Level	\$43.61	5A	1M		View
Spokane	Tile, Marble & Terrazzo Finishers	Journey Level	\$35.73	5A	1M		View
Spokane	Traffic Control Strippers	Journey Level	\$47.68	7A	1K		View
Spokane	Truck Drivers	Asphalt Mix Over 20 Yards	\$46.42	5D	1V	8M	View
Spokane	Truck Drivers	Asphalt Mix To 20 Yards	\$46.05	5D	1V	8M	View
Spokane	Truck Drivers	Dump Truck	\$46.05	5D	1V	8M	View
Spokane	Truck Drivers	Dump Truck & Trailer	\$46.42	5D	1V	8M	View
Spokane	Truck Drivers	Other Trucks	\$45.94	5D	1V	8M	View
Spokane	Truck Drivers - Ready Mix	Transit Mixers 20 yards and under	\$46.42	5D	1V	8M	View
Spokane	Truck Drivers - Ready Mix	Transit Mixers over 20 yards	\$46.75	5D	1V	8M	View
Spokane	Well Drillers & Irrigation Pump Installers	Irrigation Pump Installer	\$21.00		1		View
Spokane	Well Drillers & Irrigation Pump Installers	Oiler	\$13.50		1		View
Spokane	Well Drillers & Irrigation Pump Installers	Well Driller	\$18.00		1		View

Benefit Code Key – Effective 3/4/2020 thru 9/1/2020

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 (8) hour workweek day or a four-ten (10) hour workweek day and the first eight (8) hours worked the next day after either workweek 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.

Overtime Codes Continued

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.

- 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.

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

Overtime Codes Continued

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.

Overtime Codes Continued

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 at 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.

Overtime Codes Continued

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

5. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day (7).
- B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, the day before Christmas, and Christmas Day (8).
- C. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).
- D. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8).
- H. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Day after Thanksgiving Day, And Christmas (6).
- I. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).
- J. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Eve Day, And Christmas Day (7).
- K. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9).
- L. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (8).
- N. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, The Friday After Thanksgiving Day, And Christmas Day (9).
- P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday And Saturday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9). If A Holiday Falls On Sunday, The Following Monday Shall Be Considered As A Holiday.
- Q. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

Holiday Codes Continued

5. R. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day After Thanksgiving Day, One-Half Day Before Christmas Day, And Christmas Day. (7 1/2).
- S. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, And Christmas Day (7).
- T. Paid Holidays: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, Christmas Day, And The Day Before Or After Christmas (9).
- Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).
6. A. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).
- E. Paid Holidays: New Year's Day, Day Before Or After New Year's Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and a Half-Day On Christmas Eve Day. (9 1/2).
- G. Paid Holidays: New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Christmas Eve Day (11).
- H. Paid Holidays: New Year's Day, New Year's Eve Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, Christmas Day, The Day After Christmas, And A Floating Holiday (10).
- I. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, And Christmas Day (7).
- T. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Last Working Day Before Christmas Day, And Christmas Day (9).
- Z. 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.
7. A. 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.
- B. 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.
- C. 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.

Holiday Codes Continued

7. D. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Unpaid Holidays: President's Day. Any paid holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any paid holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.
- 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.
- G. Holidays: New Year's Day, Memorial Day, Independence 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.
- 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.
- P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, 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.

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, Day before or after New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day before or after Christmas 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.
- B. Holidays: New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day. (9)
- C. 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)

Holiday Codes Continued

15. D. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, and the day after Christmas.
- E. Holidays: the day before New Years's Day, New Year's Day, Martin Luther King, Jr. Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Friday after Thanksgiving Day, the day before Christmas, and Christmas Day. (12)

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.

Note Codes Continued

8. V. 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'.
- W. Meter Installers work on single phase 120/240V self-contained residential meters. The Lineman/Groundmen rates would apply to meters not fitting this description.
- X. 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.)
- Y. 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.
- Z. 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.)

Note Codes Continued

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

- A. Reference Document: Owner Nonconformance Report (NCR).
- 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: Contractor shall:
 - 1. The Cooling Tower and associated equipment is detrimental to the operation of the HERB HVAC system which serves the Vivarium and other areas of the building. The existing system shall remain fully operational and no demolition may occur until October 19th to ensure that cooling needs of the vivarium may be maintained should a warming trend be encountered in the late fall or early winter months.
 - 2. Should access to the Vivarium be required, Contractor shall provide two weeks notice.
 - 3. Contractor will need to provide two weeks' notice prior to the use of rock hammers, roto hammers or other devices that create loud noise or vibrations. Contractors shall coordinate all activities with the Owner to minimize impacts to the vivarium.
 - 4. Contractor shall utilize the east quarter of the HERB Parking Lot for project staging, refuse containers and employee parking. Any parking outside vehicles, storage units or equipment outside of this area will require that the Contractor obtain a Parking Pass from WSU Parking Services. There is a (per/stall) parking cost associated with this. ADA parking stalls will not be blocked.
 - 5. The Contractor may utilize the HERB loading dock for loading and unloading operations for up to a maximum of 4 hours. Longer periods of time may be scheduled with WSU Facility Operations.
 - 6. Shutdowns to the existing heating systems must be coordinated with Facility Operations should they be required for a limited time period. All

shutdowns must be approved by Facility Operations and scheduled two weeks in advance.

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. Resolve differences or disputes between Subcontractors and materials suppliers concerning coordination, interference, or extent of Work between sections;
4. Be in charge of and responsible for the Work and the Project site, including directing and scheduling all Work; and
5. 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 required 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. The schedule shall include activity description, activity start and end dates. The schedule shall emphasize milestone dates and date of Substantial Completion. Schedule shall clearly identify the critical path schedule elements.

- B. Progress Schedule shall be in Bar Chart format.
- C. Schedule activities longer than 14 days shall be sufficiently detailed.
- D. Participate in schedule update meetings and provide updated Progress Schedules.

1.04 CONTRACTOR'S PROGRESS SCHEDULE

- A. Within three calendar days of receiving WSU comments on the preliminary Progress (Bar Chart) Schedule, the Contractor shall prepare and submit a detailed Progress (Bar Chart) 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, as well as show how the Contractor plans to complete all remaining Work. The accepted Contractor's Progress (Bar Chart) Schedule and subsequent updates shall be the basis for consideration and analysis of requests for time extensions.
- B. Updates:
 - 1. The Contractor is required to prepare and submit an updated Progress (Bar Chart) Schedule as agreed upon at the Pre-construction Meeting.
 - 2. The Contractor and Owner's Designated Representative will review the updated schedule and will discuss any differences or issues raised. Decisions made and agreed to by all parties are binding. However, no contracted completion dates will be modified except by an approved Contract Change Proposal and subsequent Change Order.
 - 3. Timely submission of updates is of significant and crucial importance to the management of this Project. Lack of or late receipt of updates diminishes their value to the Project. Therefore, at the Owner's Designated Representative discretion, partial payment may be withheld for a late update as may be determined by the Owner's Designated Representative in consideration of the value of the update at the time of receipt, the circumstances of the late submittal, and the level of progress achieved on the Project.
- C. 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.
- D. 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.

- E. 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

Short Duration Projects/Uncomplicated Projects

- A. Contractor shall utilize Microsoft Project or Primavera P6 unless otherwise agreed to by Owner.

Long Duration/Complex Projects

- B. Contractor shall utilize Primavera P6 unless otherwise agreed to by Owner.
- C. 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.

PART 3 EXECUTION

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:
 - a. Underground pipe arrangements/valves/structures.
 - 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. Cooling Tower and Associated Equipment
2. Indoor Air Quality Management Plan
3. Site Safety and Health Plan (for information only)
4. Quality Control / Quality Assurance Plan
5. Waste Management Plan
6. Progress Schedule
7. Schedule of Values
8. Pre-Construction Photographs
9. Emergency Points of Contact
10. List of Subs and Suppliers
11. Demolition Plan
12. 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.
- C. Coordination Drawings:
 1. Contractor and Subcontractors shall prepare and submit coordinated Shop Drawings at a scale not less than 1/4" = 1'0". Clearly show how the Work is to be installed or constructed in relation to the Work of other Subcontractors. Required coordinated Shop Drawings shall include but not be limited to the following:
 - a. HVAC and controls Subcontractors shall prepare drawings indicating location, size, and elevation of ductwork, hangers, seismic bracing, grilles, registers, equipment, access (clear) areas to service equipment, and ceiling access doors.

- b. Plumbing Subcontractor shall prepare drawings indicating location and elevation of piping, hangers, seismic bracing, valves, cleanouts, access doors, fixtures, and required access (clear) areas for service of fixtures.
 - c. Electrical Subcontractor shall prepare drawings indicating the layout of fixtures, conduit runs 2" in diameter or greater, clearances, pull boxes, junction boxes, sound system speakers, cable trays and hangers, electrical equipment, panels, and access areas for equipment and panels.
- 2. Contractor shall meet with its Subcontractors to resolve any apparent conflicts in the coordinated Shop Drawings.
- 3. When these drawings have been coordinated to the satisfaction of Contractor and each applicable Subcontractor, Contractor and the applicable Subcontractor will sign and date a certification indicating that:
 - a. all related conditions have been reviewed;
 - b. no apparent conflicts exist;
 - c. the requirements of the Contract Documents have been complied with; and
 - d. all elements of a complete installation are included.
- 4. Maintain and submit all coordinated Shop Drawings as part of the Project Record (see Section 01 78 39 – Project Record).

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 – NOT USED

- 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.
 - 4. Visual qualities of sight exposed 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 City of Spokane, 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 the City of Spokane 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 the City of Spokane 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 the City of Spokane 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

- A. International Building Code (IBC), current adopted edition.
- B. International Fire Code (IFC), current adopted edition.
- C. National Fire Protection Association (NFPA) Codes.
- D. American Society of Mechanical Engineers (ASME), ASME A17.1 Safety Code for Elevators and Escalators, current adopted edition.
- E. American Society of Mechanical Engineers (ASME), ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts, current adopted edition.
- F. State of Washington, WAC-51-50-1101, Accessibility, as adopted by the State of Washington.
- G. International Code Council (ICC)/American National Standards Institute (ANSI) A117.1 Accessible and Usable Buildings and Facilities, current adopted edition.
- 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.
- L. Washington State Ventilation and Indoor Air Quality Code, WAC 51-13.

- M. Washington State Energy Code, WAC 51-11C. Shortened
- N. Mechanical Work: International Mechanical Code (IMC), current adopted edition.
- O. Plumbing Work: Uniform Plumbing Code (UPC) as amended and adopted by the State of Washington, in the Washington Administrative Code (WAC).
- 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).
 - 4. National Electric Safety Code (NESC).

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

- A. Pursuant to RCW 39.04.320, if the Contact Sum exceeds one million dollars no less than fifteen percent of the Labor Hours must be performed by apprentices, unless a different amount is permitted or otherwise required by law.

- B. Apprentice hours shall be performed by participants in training programs approved by the Washington State Apprenticeship Council.
- C. "Labor hours" means the total hours of workers receiving an hourly wage who are directly employed on the site of the public works project. "Labor hours" includes hours performed by workers employed by Contractor and all Subcontractors working on the Project. "Labor hours" does not include hours worked by foremen, superintendents, owners, and workers who are not subject to prevailing wage requirements of RCW 39.12.
- D. During the term of this Contract, the Owner may adjust the apprentice labor hour requirement upon its finding or determination that includes:
 - 1. A demonstration of lack of availability of apprentices in the geographic area of the Project;
 - 2. A disproportionately high ratio of material costs to labor hours that does not make feasible the required minimum levels of apprentice participation;
 - 3. Demonstration by participating contractors of a good faith effort to comply with the requirements of RCW 39.04.300, RCW 39.04.310, and RCW 39.04.320;
 - 4. Small contractors or subcontractors (e.g., small or emerging businesses) would be forced to displace regularly employed members of their workforce;
 - 5. The reasonable and necessary requirements of the Contract render apprentice utilization infeasible at the required level (e.g., the number of skilled workers required and/or limitations on the time available to perform the Work preclude utilization of apprentices); or
 - 6. Other criteria the Owner deems appropriate, which are subject to review by the office of the Governor.
- E. Contractor shall report apprentice participation to the Owner at least quarterly, on forms provided or approved by the Owner. In addition, copies of certified payroll records may be requested to document the goal. These reports shall include:
 - 1. The name of the Project;
 - 2. The dollar value of the Project;
 - 3. The date of the Notice to Proceed;
 - 4. The name of each apprentice and apprentice registration number;
 - 5. The number of apprentices and labor hours worked by them, categorized by trade or craft;

6. The number of journey level workers and labor hours worked by them, categorized by trade or craft; and
7. The number, type, and rationale for the exceptions granted.

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 296-62-07722(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:

1. Contractor is responsible for fully complying with WAC 246-260. A construction permit application shall be submitted to the appropriate jurisdictional authority for approval prior to the commencement of construction. WSU EH&S shall be consulted prior to the development of a construction permit application. Contractor shall ensure that the appropriate regulatory authority inspects and approves the site prior to operation.

H. Food Service Facilities:

1. Contractor is responsible for fully complying with WAC 246-215. A construction permit application shall be submitted to the appropriate jurisdictional authority for approval prior to the commencement of construction. WSU EH&S shall be consulted prior to the development of a construction permit application. Contractor shall ensure that the appropriate regulatory authority inspects and approves the food service prior to operation.

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. Contractor 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 Contractor'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: Contractor 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. Contractor'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 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.
 - 2. Geotechnical inspection will be performed by a licensed geotechnical consulting firm.

1.04 DUTIES OF CONTRACTOR'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. Owner; and
 - 4. 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;
 - 4. Notice, Review and Appeal.

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
 - 6. Cost.
- 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. 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 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. Contractor shall be responsible for furnishing waste collection containers, servicing those containers, and disposing solid waste from the Project, with the exception of unacceptable and dangerous waste.
- D. 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

- A. Construction Waste: Waste resulting from the Work.
- 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 disposed 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.
 - 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 No.9015
Health Education and Research Building**

**Spokane HERB Building Cooling Tower Replacement
2020**

**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:
- Protect workers on the site from air quality problems during construction.
 - Prevent indoor air quality problems in the completed facility.
 - 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:
- Draft and submit the IAQ Management Plan to Owner for acceptance.
 - Document IAQ Management Plan progress on a weekly basis.
 - 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.
 - Identify IAQ problems and institute remedial action as necessary.
 - 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.

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 removal):

- 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;
 - A plan and schedule for inspection and maintenance of indoor air quality measures;
 - Installation sequencing for porous materials, including paint;
 - Measures to be employed to protect ducts and stored on-site or installed absorptive materials from moisture damage;
 - Type of filtration media used during construction and;
 - Cleanup of contaminated components after construction.
- B. 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.
- C. 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. This final plan shall address all review comments noted on the draft submittal and be submitted prior to the commencement of construction.

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:
- 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.
 - Avoid the use of products, materials and operations that would cause IAQ problems or concerns.
 - 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.
 - Provide ventilation as may be necessary to protect workers' health and

avoid the accumulation of volatile compounds, dust and other harmful airborne contamination.

- 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.
 - Provide data sheets of filtration media used during construction and installed prior to building occupancy.
 - 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:
- Isolate the space;
 - Provide plastic sheet separation during sanding;
 - Close and seal all air system devices and ductwork; and
 - 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 COMPLETION PROCEDURES

- A. Remove all IAQ measures as well as signs, framing, and supports at completion of Project.

END OF SECTION 01 81 19

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and Owner's operational needs. This begins in the design phase and continues through construction. The commissioning process incorporates the traditionally separate functions of system documentation, equipment startup, control system calibrations, testing and balancing, performance testing, and training. Commissioning during the construction phase is intended to achieve the following specific objectives:
 - 1. Verify that applicable equipment and systems are installed according to the Contract, manufacturer's recommendations, and industry accepted standards and that they receive adequate operational checkout by installing contractors.
 - 2. Verify and document proper functional performance of equipment and systems.
 - 3. Document all non-performing equipment and systems and track corrective actions through to final resolution.
 - 4. Ensure compliance with State Energy Code Requirements (WA NREC Latest Revision).
- B. Work includes the completion of formal commissioning procedures on selected equipment and systems. Commissioning procedures will be designed and coordinated under the direction of a Commissioning Agent (CA). Contractor is not responsible for hiring the CA. The CA will work directly for Owner. Contractor is responsible for coordinating and cooperating with the CA as necessary to complete the training and commissioning processes.

1.02 DEFINITION OF TERMS

- A. Commissioning Agent (CA): Is an independent third-party consultant under contract with Owner. CA responsibilities are listed in Subsection 1.03 for information, reference, and clarification.
- B. Installation Verification Audit: Includes the on-site inspection and review of related system components for conformance to the Contract. The CA will check for proper systems installation and verify systems readiness for function testing. Noted deficiencies will be documented and must be satisfactorily resolved prior to continuing with commissioning on the affected component or system.
- C. Commissioning Plan: Outlines the commissioning process. Provides a brief overview of each start-up and functional test to be performed and identifies the responsible Contractor and/or supplier. It also outlines the responsibilities of all personnel to the commissioning process, estimates the commissioning schedule and provides sample Installation Verification, Start-Up, and Functional Performance Test Procedures and related documentation for information.

- D. Start-Up Testing: Initial test checkout of component or systems completed prior to functional performance testing. The start-up tests verify that the equipment is installed and operating properly per the Contact.
- E. Testing, Adjusting and Balancing (TAB): Testing, adjusting and balancing is a process where heating and air conditioning systems are tested against design standards, adjusted for maximum efficiency, and balanced to provide optimum performance. The Work typically covers balancing and adjusting air and water distribution in areas of the building served by an HVAC system, and verification and adjustment of heating and cooling loads to insure proper indoor environmental conditions. Areas that do not meet the design standards are referred to the appropriate party for correction. Reports are prepared documenting performance and compliance with design standards.
- F. Function Performance Testing: Includes the documented testing of individual components and equipment under actual operating conditions. Final performance commissioning of systems will begin only after Contractor certifies that system components are 100% complete, start-up test results have been accepted, and the CA agrees that systems are ready for functional testing.
- G. Commissioning Issues Log: Generated by the CA, includes deficiencies discovered during the commissioning process. The log identifies the responsible contractor, current disposition of issues, and the date of final resolution as confirmed by the CA. Deficiencies are defined as those issues where products, execution or performance do not satisfy the Contract, the design intent or Owner's need.
- H. Final Commissioning Report: Includes the overall final commissioning document, prepared by the CA, which details the actual commissioning procedures performed, inspection and testing results, and the final version of the Commissioning Issues Log indicating that all issues discovered through the commissioning process have been verified as resolved.

1.03 COMMISSIONING AGENT'S DUTIES AND RESPONSIBILITIES

- A. Meet and communicate with the Owner's Designated Representative, Contractor, equipment representatives, and others as necessary to facilitate the commissioning process.
- B. Write the commissioning plan.
- C. Review commissioning-related Specifications, submittals, and Contract Documents. Communicate noted deficiencies and concerns to Owner.
- D. Review the Owner Project requirements and Basis of Design documents to insure Owner's intent and design requirements are met.
- E. Chair controls integration meetings to ensure acceptance of control strategies and determine methods to achieve the required sequence of operation.

- F. Develop installation and start-up checklists from:
 - 1. Information in the Contract Documents; and
 - 2. Information from equipment manufacturers as provided by Contractor.
- G. Coordinate functional testing procedures with Contractor and integrate into Progress Schedule.
- H. Develop detailed and specific inspection and functional testing procedures for equipment and systems to be commissioned.
- I. Confirm completion of all static piping and duct tests and flushing and cleaning as performed by Contractor.
- J. Complete a detailed physical inspection and visual checkout of commissioning related equipment and components. Document specific deficiencies for resolution.
- K. Confirm completion of equipment and systems start-up procedures as performed by Contractor and equipment representatives. Verify appropriate documentation is completed and provided for inclusion in the final commissioning report. Record noted deficiencies.
- L. Schedule and coordinate the final on-site functional testing process. Complete a documented checkout of every specified operating parameter and mode. Document deficiencies and resolutions.
- M. Review Contractor-provided O&Ms. Ensure the manuals provide in-depth, Project-specific information. Provide formal comment.
- N. Work with Owner, Architect/Engineer, if any, and Contractor to satisfactorily resolve outstanding issues.
- O. Provide Owner with final, complete, and documented verification to ensure commissioned systems are 100% operational per Contract, prior to Owner's acceptance. Exceptions may be made for seasonal commissioning.
- P. Perform seasonal commissioning as required to verify proper system operation during peak heating and cooling seasons.
- Q. Complete all other items noted in Contract as Commissioning Agent responsibilities.
- R. Provide a final Commissioning Report to Owner.

1.04 DUTIES AND RESPONSIBILITIES FOR COMMISSIONING

- A. The commissioning process will require the active participation of persons qualified to represent the following interests:

1. Owner,
 2. Contractor,
 3. Equipment manufacturer's representatives,
 4. Mechanical Subcontractor,
 5. HVAC Subcontractor,
 6. Controls Subcontractor,
 7. TAB Subcontractor,
 8. Electrical Subcontractor, and
 9. Others as appropriate.
- B. The CA will coordinate, schedule, and oversee the final functional performance commissioning process. Participants shall include in their contracts all costs necessary to participate in and complete the commissioning process.
- C. Contractor will assure the participation and cooperation of Subcontractors and coordinate with Owner and Architect/Engineer, as required for the commissioning process.

Owner will assure the participation of its chosen representatives.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES FOR COMMISSIONING

- A. Contractor shall provide material, equipment, and tools to facilitate completing the functional performance testing process. The CA will provide specialized and calibrated test equipment to perform the calibration and functional performance testing.
- B. Contractor shall budget and provide sufficient time and qualified personnel to participate on-site in this process until the process is successfully completed and all deficiencies have been corrected or otherwise resolved.
- C. Contractor shall provide training to Owner. Specified training on related systems and equipment operation and maintenance shall only commence after final performance commissioning is successfully completed, and systems are verified by the CA to be 100% complete and functional.
- D. Contractor shall reimburse the CA for repeated test failures. After a second failed start-up or functional performance test, the CA and Owner shall be entitled to additional compensation for time and expenses involved with re-testing. The compensation shall be at published company billing rates.
- E. Owner will not accept equipment and systems, and Owner will generally not make final payment, until all equipment and systems have been successfully

commissioned and all specified requirements have been satisfied.

- F. Include a line item for commissioning in the Schedule of Values. Ensure sufficient costs are included for Contractor's expenses related to all commissioning tasks.

END OF SECTION 01 91 00

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including Washington State
- 1. University General Conditions for Washington State Facility Construction, Special Provisions and General Requirements, apply to the work specific in this section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure as described in Section 3 below. Generally, the demolition includes the partial removal and disposal of the existing cooling tower, tower foundation, select electrical systems, select mechanical systems, and related demolished materials, as shown on drawings and herein specified.

1.03 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 2. Coordination for shutoff, capping, and continuation of utility services.
 - 3. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 4. Means of protection for items to remain and items in path of waste removal from building.

1.04 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.04 PROJECT CONDITIONS

- A. Owner will occupy portions of building and areas immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Division 01 Section 01 50 00 "Construction Facilities and Temporary Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3.03 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated.
- B. Scope of Work – The work includes but is not limited to items noted on drawings.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.
- D. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- E. Burning: Do not burn demolished materials.
- F. Existing Landscape Protection: Protect existing landscape trees, plantings, ground covers and irrigation systems at adjoining areas to construction and staging.

3.04 CLEANING

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

END OF SECTION 02 41 19

WSU SPOKANE HERB BUILDING COOLING TOWER REPLACEMENT

**SPOKANE, WA
MW PROJECT #2019.006.02**

PROJECT SPECIFICATIONS

PREPARED BY

MW Consulting Engineers
North 222 Wall Street Suite 200
Spokane WA 99201-0813
Telephone (509) 838-9020
Fax (509) 838-1123



06-05-2020

DIVISION 03

SECTION 030100
MAINTENANCE OF CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete reinforcement repair.
 - 2. Concrete surface repair.
 - 3. Concrete crack repair at existing building or where concrete is impacted by demolition.
- B. Related Sections:
 - 1. Section 03 2000 - Concrete Reinforcing.
 - 2. Section 03 3000 - Cast-In-Place Concrete.
 - 3. Section 03 3500 - Concrete Curing and finishing.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Repair Surface:
 - 1. Basis of Measurement: By the square foot.
 - 2. Basis of Payment: Includes surface preparation, reinforcement and concrete repair, and finishing.
- B. Crack Repair:
 - 1. Basis of Measurement: By the linear foot.
 - 2. Basis of Payment: Includes surface preparation, injection ports, repair materials, and surface finishing.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM A615 - Standard Specification for Deformed and Plain-Steel Bars for Concrete Reinforcement.
 - 2. ASTM C33/ - Standard Specification for Concrete Aggregates.
 - 3. ASTM C109 - Standard Test Method for Compressive strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
 - 4. ASTM C150 - Standard Specification for Portland Cement.
 - 5. ASTM C293 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading).
- B. American Welding Society:
 - 1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

- C. Samples: Submit two color samples for patches exposed to view in finished construction and required to match existing.
- D. Manufacturer's Instructions: Submit mixing instructions.
- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Accurately record actual locations of structural reinforcement repairs and type of repair.
- C. Operation and Maintenance Data: Procedures for submittals.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301
- B. Perform welding work in accordance with AWS D1.4.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Design reinforcement splices under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.
- C. Applicator: Company specializing in concrete repair with minimum 3 years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Comply with instructions for storage, shelf life limitations and handling.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Recycled Content Materials: Furnish materials with maximum available recycled content.
- B. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles (800 km) of Project site.

2.2 EPOXY MATERIALS

- A. Approved Manufacturers:
 - 1. BASF.
 - 2. Dayton Superior Corporation.
 - 3. The Euclid Chemical Company.

4. Sika Construction Products.
5. L&M Construction Chemical.
6. Simpson Strong Tie.
7. Hilti.
8. Substitutions: Section 01 2500 - Substitution Procedures.

- B. Concrete Repair Epoxy Adhesive: Two-part epoxy adhesive containing 100 percent solids, 100% reactive compound suitable for use on dry or damp surfaces, meeting the following minimum characteristics:

Characteristic	Test Method	Results
Bond Strength	ASTM C882	2,500 psi
Tensile Strength	ASTM D638	4,400 psi
Elongation	ASTM D638	2 percent at 7 days 70 degrees F
Flexural Strength	ASTM D790	6,700 psi
Compressive Strength	ASTM D695	6,500 psi
Water Absorption	ASTM D570	2% maximum

- C. Concrete Repair Epoxy Bonding Resin: Two-part epoxy resin containing 100 percent solids, meeting the following minimum characteristics:

Characteristic	Test Method	Results
Bond Strength	ASTM C882	2,700 psi
Tensile Strength	ASTM D638	5,600 psi
Elongation	ASTM D638	2 percent at 7 days 70 degrees F
Flexural Strength	ASTM D790	8,000 psi
Compressive Strength	ASTM D695	6,500 psi

- D. Aggregate: Type recommended by mortar manufacturer.

2.3 CEMENTITIOUS MORTAR MATERIALS

- A. Approved Manufacturers:
1. BASF.
 2. Dayton Superior Corporation.
 3. The Euclid Chemical Company.
 4. Sika Construction Products.
 5. L&M Construction Chemical.
 6. Simpson Strong Tie.
 7. GCP Applied Technologies.
 8. RAECO.
 9. Substitutions: Section 01 2500 - Substitution Procedures
- B. Cementitious Mortar: Packaged latex modified silica fume enhanced Portland cement patching mortar with the following properties:
1. Compressive Strength: ASTM C109; minimum 2,000 psi after one day and 4,000 psi after 28 days.
 2. Bond Strength: ASTM C882; minimum 2,200 psi after 28 days.
 3. Flexural Strength; ASTM C293; minimum 1,500 psi after 28 days.
- C. Aggregate: Type recommended by mortar manufacturer.

2.4 RELATED MATERIALS

- A. Cast Underlayment: Compound: Free-flowing, self-leveling, pumpable cementitious base compound. Refer to Section 03 5400.
1. Flo-Top/Super Flo-Top by The Euclid Chemical Company.

2. SLU by US Spec.
 3. Mastertop 110 plus Underlayment BASF.
 4. Levelex by L&M Construction Chemicals.
 5. Substitutions under provisions of Section 012500 - Substitution Procedures.
- B. Bonding Agent for Flooring: As recommended by topping product manufacturer.
- C. Bonding Agent for Concrete to Concrete: Refer to Section 03 3000.
- D. Refer to Section 03 3000 - Cast-in-Place Concrete for additional related materials.
- E. Portland Cement: ASTM C150.
- F. Sand: ASTM C33; uniformly graded, clean.
- G. Water: Clean and potable.
- H. Calcium Chloride: Not permitted.

2.5 REINFORCEMENT MATERIALS

- A. Refer to Section 03 2000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces are ready to receive work.
- C. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

- A. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination; wire brush using cleaning agent recommended by product manufacturer rinse surface and allow to dry.
- B. Flush out cracks and voids with agent recommended by product manufacturer to remove laitance and dirt. Chemically neutralize by rinsing with water.
- C. For areas repaired using the injection method, provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than depth of crack to be filled or port size diameter no greater than thickness of crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.
- D. For areas patched with epoxy mortar, remove broken and soft concrete as recommended by product manufacturer. Remove corrosion from steel. Clean surfaces mechanically; wash with agent recommended by product manufacturer; rinse with water.
- E. Sandblast clean exposed reinforcement steel surfaces. Mechanically cut away damaged portions of bar.

3.3 REPAIR WORK

- A. Repair reinforcement by welding new bar reinforcement to existing reinforcement with sleeve splices. Strength of welded splices and reinforcement to exceed original stress values.
- B. Repair exposed structural, shrinkage, and settlement cracks of concrete by epoxy injection, epoxy application or bonding agent and cementitious paste method.
- C. Repair spalling. Fill voids flush with surface. Apply surface finish.

3.4 MIXING EPOXY MORTAR

- A. Mix epoxy mortars to consistency for purpose intended, as recommended by the manufacturer.
- B. Mix components in clean equipment or containers. Conform to pot life and workability limits.

3.5 MIXING CEMENTITIOUS MORTAR

- A. Mix cementitious mortar to consistency required for purpose intended, as recommended by the manufacturer.
- B. Provide bonding agent as additive to mix as recommended by the mortar manufacturer. Use manufacturers approved bonding agent.

3.6 INJECTION - EPOXY RESIN

- A. Inject epoxy resin adhesive into prepared ports under pressure using equipment appropriate for particular application per manufacturer's written instructions.
- B. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.
- C. Remove temporary seal and excess adhesive.
- D. Clean surfaces adjacent to repair and blend finish.

3.7 APPLICATION - EPOXY MORTAR

- A. Apply product per manufacturer's written instructions.
- B. Trowel apply mortar mix to average thickness not to exceed mortar manufacturer's recommendations. Tamp into place filling voids at spalled areas.
- C. For patching honeycomb, trowel mortar onto surface, work mortar into honeycomb to bring surface flush with surrounding area. Finish trowel surface to match surrounding area.
- D. Cover exposed steel reinforcement with epoxy mortar, feather edges to flush surface.

3.8 APPLICATION - CEMENTITIOUS MORTAR

- A. Apply product per manufacturer's written instructions.
- B. Apply coating of bonding agent to concrete surfaces as recommended by manufacturer. Provide full surface coverage.

- C. Apply cementitious mortar by steel trowel to average thickness not to exceed mortar manufacturer's recommendations. Tamp into place filling voids at spalled areas. Work mix into honeycomb.
- D. Damp cure cementitious mortar as recommended by mortar manufacturer.

3.9 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Testing, inspection and analysis requirements.

END OF SECTION

SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formwork for cast-in place concrete.
 - 2. Shoring, bracing and anchorage.
 - 3. Form accessories.
 - 4. Form stripping.
 - 5. Waterstops.
 - 6. Bolts and anchors.
- B. Related Sections:
 - 1. Section 030100 - Maintenance of Concrete.
 - 2. Section 032000 - Concrete Reinforcing.
 - 3. Section 033000 - Cast-In-Place Concrete.
 - 4. Section 033500 - Concrete Curing and Finishing.
 - 5. Division 22- Product requirements for mechanical items for placement by this Section.
 - 6. Division 26- Product requirements for electrical items for placement by this Section.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 - Specifications for Structural Concrete.
 - 3. ACI 318 - Building Code Requirements for Structural Concrete.
 - 4. ACI 347 - Guide to Formwork for Concrete.
- B. American Forest and Paper Association:
 - 1. AF&PA - National Design Specifications for Wood Construction.
- C. The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- D. American Society of Mechanical Engineers:
 - 1. ASME A17.1 - Safety Code for Elevators and Escalators.
- E. ASTM International:
 - 1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
 - 2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- F. West Coast Lumber Inspection Bureau:
 - 1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.

- B. Product data for proprietary materials and items, including forming accessories, waterstops, and other as requested Architect.
- C. Submit ICC reports for each product where ICC approval is required.
- D. Delegated Submittals: Adhesive Anchor Installer certification by the ACI-CRSI Adhesive Anchor Installation Certification Program when installation by certified installer is required, refer to part 3 below.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. For wood products furnished for work of this Section, comply with AF&PA.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Products storage and handling requirements.
- B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.6 COORDINATION

- A. Section 013000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Design, engineer, and construct formwork, shoring, and bracing according to ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line, and dimension as indicated on Drawings.

2.2 FORM MATERIALS

- A. Form Materials for Unexposed Surfaces: At discretion of Contractor. Where waterproofing is required, surface roughness must be compatible with waterproofing manufacture's requirements.
- B. Form Material for Exposed Surfaces: Overlay Plywood.
 - 1. Forms: Conform to PS 1; AC or BB high density overlaid concrete form, Class 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
 - 2. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA "B-B Plyform Structural I Exterior" grade.
 - 3. Plywood where "Smooth Finish" is required, as indicated on Drawings: APA/EWA "HD Overlay Plyform Structural I Exterior" grade, minimum of 3/4 inch thick
- C. Material for formwork and shoring which is to be left in place: Non-organic material only. At the discretion of the Architect. Void cannot be filled.

2.3 FORMWORK ACCESSORIES

- A. Form Ties:
 - 1. Carbon steel wire snap-off type, adjustable length, 1" x 1" plastic cone type, 1" break back dimension, free of defects that could leave holes larger than 1 1/4" in concrete surface.
 - 2. Substitutions: Section 012500 – Substitution Procedures.
- B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.
- C. Form Anchors and Hangers:
 - 1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
 - 2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
 - 3. Penetration of structural steel members is not permitted.
- D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.
- E. Corners: Chamfer as 3/4" x 3/4" unless noted otherwise; maximum possible lengths.
- F. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, release tape sealed slots, anchors for securing to concrete formwork. Surface applied reglets are not allowed.
 - 1. Manufacturers:
 - a. Fry Reglet "CO" concrete reglet, 26 gauge galvanized steel.
 - b. Substitutions: Section 012500 - Substitution Procedures. 01
- G. Vapor Retarder: Refer to Section 072600.
- H. Bituminous Joint Filler: ASTM D1751.
- I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.
- J. Keyways shall be formed using wood or removable plastic or metal preformed units to sizes indicated.

2.4 CONCRETE ACCESSORIES

- A. Adhesive Anchor: Two-part, self-mixing, cartridge type epoxy adhesive for anchoring thread rebar and all thread rod. Acceptable Manufacturers:
 - 1. Simpson Strong Tie; "SET- XP Epoxy"
 - 2. DeWalt, "Pure110+"
 - 3. Redhead; "Epcon C6+ Fast Curing Epoxy"
 - 4. Hilti; "Hit-RE 500-SD System"
 - 5. Use subject to approval by ICC
 - 6. For applications in temperatures below what is set by the Manufacturer use Cold Weather Adhesive Anchor per manufacturers requirements
 - 7. Substitutions under provisions of Section 012500 – Substitution Procedures.
- B. Cold Weather Adhesive Anchor: Acceptable Products:
 - 1. Hilti; Hit-Ice.
 - 2. Simpson; "AT-XP"
 - 3. DeWalt; AC100+Gold (CMU)

4. DeWalt "AC200+"
 5. Use subject to approval by ICC
 6. Substitutions under provisions of Section 012500 – Substitution Procedures.
- C. Expansion Bolts:
1. Simpson Strong Tie Co.; Strong-Bolt 2
 2. DeWalt - Power-Stud + SD2
 3. Hilti; Kwik Bolts T-Z.
 4. Use subject to approval by ICC
 5. Substitutions under provisions of Section 012500 – Substitution Procedures.
- D. Screw Anchors (1 piece carbon steel threaded bolt for concrete):
1. Simpson Strong Tie-Co.; Titan H.
 2. DeWalt Screw Bolt+.
 3. DeWalt, Snake+.
 4. Hilti, Inc.; Kwik HUS.
 5. Substitutions under provisions of Section 012500 – Substitution Procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 013000 – Administrative Requirements. Ensure that dimensions agree with drawings.
- B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.
- C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

- A. Earth Forms:
 1. Earth forms are permitted at bottom of sloped footings at change of level only and only if soil on sides is firm.
 2. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.
 3. Verify locations with Structural Engineer and Geotechnical Engineer.
 4. Earth forms are not permitted without approval.
- B. Do not reuse formwork that will perform less well than new. Do not patch formwork.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval from Architect before framing openings in structural members which are not indicated on Drawings.
- F. Provide chamfer strips on external corners of all exposed to view concrete.

- G. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- H. Formwork - General:
 - 1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
 - 2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
 - 3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
 - 4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
 - 5. Complete wedging and bracing before placing concrete.
- I. Forms for Smooth Finish Concrete:
 - 1. Use steel, plywood or lined board forms.
 - 2. Use clean and smooth plywood, uniform in size and free from surface and edge damage capable of affecting resulting concrete finish.
 - 3. Install form lining with close-fitting square joints between separate sheets without springing into place.
 - 4. Use full size sheets of form lines and plywood wherever possible.
 - 5. Tape joints to prevent protrusions in concrete.
 - 6. Use care in forming and stripping wood forms to protect corners and edges.
 - 7. Level and continue horizontal joints.
 - 8. Keep wood forms wet until stripped.
- J. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- K. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

3.3 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices and embedded items.
- C. Do not apply form release agent to formwork which is to be left in place or where concrete surfaces are indicated to receive special finishes or applied coverings that could be affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - ACCESSORIES, INSERTS, EMBEDDED PARTS AND OPENINGS

- A. Provide formed openings where required for items to be embedded in or passing through concrete work. Provide temporary access pockets for vibrating concrete at wide opening sills.
- B. Locate and set in place items required to be cast directly into concrete. Use templates to hold anchor rods in place during concrete placement.

- C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, other inserts and components of other Work.
- D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- G. Form Ties:
 - 1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
 - 2. Place ties at least 1 inch away from finished surface of concrete unless noted otherwise.
 - 3. Leave inner rods in concrete when forms are stripped.
 - 4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
 - 5. When architecturally exposed ties are used, assure the pattern and style are as detailed on the drawings.
- H. Construction Joints:
 - 1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
 - 2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
 - 3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
 - 4. Arrange joints in continuous line straight, true and sharp.
- I. Embedded Items:
 - 1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
 - 2. Do not embed wood or uncoated aluminum in concrete. Obtain installation and setting information for embedded items furnished under other Specification sections.
 - 3. Securely anchor embedded items in correct location and alignment prior to placing concrete.
 - 4. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.
- J. Screeds:
 - 1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
 - 2. Slope slabs to drain where required or as shown on Drawings.
 - 3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.
- K. Screed Supports:
 - 1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which shall not puncture the membrane.
 - 2. Staking through membrane is not permitted.
- L. Cleanouts and Access Panels:
 - 1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
 - 2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

- M. Install dowels, rebar, threaded or smooth steel dowels and all thread rebar, size and spacing to match reinforcing in adhesive anchor per manufacturers requirements, and as shown on drawings. Holes must be blown out with air gun or vacuumed out per manufacturer's requirements. Special inspection is required. Refer to general notes and special inspection drawing. See section 032000.
- N. Adhesive anchors shall be installed by an Adhesive Anchor Installer certified by the ACI-CRSI Adhesive Anchor Installation Certification Program where installed in a horizontal or upwardly inclined position and where indicated in the plans as an "adhesive tension anchor."
- O. Unless indicated, separate slabs on grade from vertical surfaces with 3/8 inch thick, joint filler indicated in Section 033000. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface. Use joint sealer 3/8" wide by 1/4" deep to seal joint. See section 079000.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. 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.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and after flatness/levelness has been approved.
- B. Loosen forms carefully. Do not wedge pry bars, hammers or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- D. Under ordinary conditions, formwork and supports shall remain in place for not less than the periods of time under schedule - Form Removal. These periods represent cumulative number of days or hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50°F. If high-early-strength concrete is used, these periods may be reduced as approved by the Architect. Conversely, if ambient temperatures remain below 50°F or if retarding agents are used, then these periods shall be increased at the discretion of the Architect.
- E. Forms and shoring in the formwork used to support the weight of concrete in beams, slabs and other structural members shall remain in place until the formwork for the supported member is allowed to be removed.
- F. Before shore removal the strength to be attained by members carrying their own dead load shall be no less than 75% of the specified strength, f'c. Furthermore the contractor shall restrict construction live loading to 50% of the design live load.

3.7 CONCRETE CURING AND FINISHING

- A. Cure concrete floors as specified in Section 033500 – Concrete Curing and Finishing.

- B. For general concrete curing refer to ACI 308.1.

3.8 ERECTION TOLERANCES

- A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117, except as otherwise indicated.
- B. Construct and align formwork for elevator hoistway(s) in accordance with ASME A17.1.
- C. Camber slabs and beams as indicated on drawings.

3.9 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting and balancing.
- B. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.
- C. Schedule concrete placement to permit formwork inspection before placing concrete.

3.10 SCHEDULE - TESTING BY OWNER-FURNISHED TESTING LAB

- A. Refer to Special Inspecting and Testing on Structural Drawings.

3.11 SCHEDULES

- A. Provide concrete as indicated and detailed on drawings.

END OF SECTION

SECTION 032000
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing bars.
 - 2. Reinforcement accessories.
- B. Related Sections:
 - 1. Section 03 0100 - Maintenance of Concrete.
 - 2. Section 03 1000 - Concrete Forming and Accessories.
 - 3. Section 03 3000 - Cast-In-Place Concrete.
 - 4. Section 03 3500 - Concrete Curing and Finishing

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 318 - Building Code Requirements for Structural Concrete.
 - 3. ACI SP-66 - ACI Detailing Manual.
- B. ASTM International:
 - 1. ASTM A615 - Standard Specification for Deformed and Plain Carbon -Steel Bars for Concrete Reinforcement.
- C. Concrete Reinforcing Steel Institute:
 - 1. CRSI - Manual of Standard Practice.
 - 2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings:
 - 1. Indicate bar sizes, spacing, locations, and quantities of reinforcing steel bending and cutting schedules and supporting and spacing devices for reinforcement and accessories in 1/4 inch minimum scale elevations and plans.
 - 2. General Contractor and Subcontractor to review shop drawings and add all proposed openings to drawings before submitting to Architect.
- C. Submit ICC reports for each product where ICC approval is required.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- E. Submit request to use splices not shown on the project drawings.
- F. Submit request to use mechanical splices not shown on the project drawings.
- G. Submit request for placement of column dowels without the use of templates.

- H. Submit request and procedure to field bend or straighten partially embedded reinforcement.
- I. Submit description of reinforcement weld locations, weld procedures, and welder qualifications.
- J. Submit proposed supports for coated reinforcement and uncoated reinforcement when it is necessary to move reinforcement beyond the specified placing tolerances to avoid interference with other reinforcement, conduits, or embedded items. Provide a submittal showing the resulting arrangement of reinforcement.
- K. Submit request to heat and bend reinforcement when required.
- L. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

- A. Deliver, store, protect and handle products to site under provisions of Section 016000 - Product Requirements.
- B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI - Manual of Standard Practice and ACI 301.
- B. Prepare shop drawings in accordance with ACI SP-66.

1.6 COORDINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate with placement of formwork, formed openings and other Work.
- C. All trades with openings in concrete or masonry are to show size and location of proposed openings on shop drawings before submitting drawings to Architect for approval.
- D. Location of reinforcement takes precedence over that of work by other trades.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: As noted on the Structural Drawings.
- B. Deformed Reinforcement: ASTM A615, 60 ksi yield grade, steel bars, unfinished.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: As noted on the Structural Drawings, or patented system as approved.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions, including CRSI "SBU" Type chairs or load bearing pads on bottom to prevent vapor retarder puncture.

- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel, Plastic tipped steel or Stainless steel type; size and shape and spacing to maintain bars in required position.
- D. Precast concrete block chairs to be made from 4000 psi concrete and have (2) 16 ga. tie wires cast in center.
- E. Expansion Bolts: Refer to Section 03 1000 - Concrete Forming and Accessories.
- F. Adhesive Anchors: Refer to Section 03 1000 - Concrete Forming and Accessories.
- G. Screw Anchors: Refer to Section 03 1000 - Concrete Forming and Accessories.
- H. Provide templates for placing column, footing anchor rods.

2.3 FABRICATION

- A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice and ACI 318.
- B. Form standard hooks for: 180 degree bends, 90 degree bend, stirrup and tie hooks, and seismic hooks as indicated on Drawings.
- C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

2.4 SHOP FINISHING

- A. Galvanized Finish for Steel Bars: ASTM A767, Class I, hot dip galvanized after fabrication.

2.5 SOURCE QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Make completed reinforcement available for inspection at manufacturer's factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. See applicable Division 3 and 4 sections.
- B. Place, support and secure reinforcement against displacement. Provide carrier bars as required to maintain position of bars. Do not deviate from required position beyond specified tolerance.
 - 1. Do not weld crossing reinforcement bars for assembly.
- C. Do not displace or damage vapor retarder.
- D. Accommodate placement of formed openings.
- E. Space reinforcement bars with minimum clear spacing in accordance with ACI 318
 - 1. Where bars are indicated in multiple layers, place upper bars directly above lower bars, unless noted otherwise.

- F. Maintain concrete cover around reinforcement in accordance with ACI 318 and as noted on the drawings.
- G. Call for special inspection. Concrete is not to be ordered for delivery until after formwork and reinforcement has been approved by the Special Inspector.

3.2 ERECTION TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Install reinforcement within the tolerances specified in ACI 301.

3.3 FIELD QUALITY CONTROL

- A. See applicable Division 3 and 4 sections.
- B. Section 01 4000 - Quality Requirements and 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.
- C. Field inspection and testing will be performed by Owner's testing laboratory in accordance with applicable code.
- D. Provide free access to Work and cooperate with appointed firm. See drawings S001 & S-101.
- E. Reinforcement Inspection: See drawings S001 & S101.

END OF SECTION

SECTION 033500
CONCRETE CURING AND FINISHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Initial and final curing of horizontal and vertical concrete surfaces.
 - 2. Tolerances.
- B. Related Sections:
 - 1. Section 0 30100 - Maintenance of Concrete.
 - 2. Section 03 1000 - Concrete Forming and Accessories.
 - 3. Section 03 3000 - Cast-In-Place Concrete.
 - 4. Section 07 9200 - Joint Sealants.
 - 5. Section 0 79500 - Expansion Control.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
 - 3. ACI 308.1 - Standard Specification for Curing Concrete.
 - 4. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - 2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - 4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.
 - 5. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and of FL Floor Levelness Numbers.
 - 6. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on concrete: hardener, sealer, curing compounds, curing sheets and slip resistant treatment; compatibilities and limitations.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and ACI 302.1R.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Applicator/Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 - Product Requirements: Product storage and handling requirements.
- B. Deliver materials in manufacturer's packaging including application instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.
- B. Temporary Heat: Ambient temperature of 50 degrees F minimum.
- C. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.9 COORDINATION

- A. Section 013000 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate the Work with concrete floor placement and concrete floor curing.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Materials and Resources Characteristics:
 - 1. Recycled Content Materials: Furnish materials with maximum available recycled content.
 - 2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles (800 km) of Project site.

2.2 CURING MATERIALS

- A. Compatibility: Determine compatibility of curing compounds with applied finishes and adhesives before starting work. Do not use incompatible products or when prohibited by resilient flooring or adhesive manufacturer. Provide curing/sealing products coordinated with the final approved flooring finishes selected.
- B. Curing Compound: ASTM C309 Type 1-D, clear or translucent with fugitive dye, waterborne, membrane forming, and curing compound. Comply with Federal Air Quality Regulations 40 CFR 52.254 Comply with VOC requirements as specified in Section 018113 - Sustainable Project Requirements.
 - 1. W.R. Meadows; 1100 Clear (Exterior use only).
 - 2. Dayton Superior Corporation; Clear Resin Cure J11W
 - 3. Substitutions Section 01 2500 – Substitution Procedures.

- C. Curing Compound: ASTM C309, Type 1, Class B, clear or translucent resin-based, water-based curing compound. Comply with VOC requirements specified in Section 018113 - Sustainable Design Requirements.
 - 1. US Spec; Maxcure Resin Clear HS (Exterior use only)
 - 2. L&M Chemicals; L&M Cure "R". US Spec; CS-25-1315.
 - 3. Dayton Superior Corporation; Clear Cure VOC J7WB
 - 4. The Euclid Chemical Company; Kurez DR VOX.
 - 5. Sinak Corp.; VC5.
 - 6. WR Meadows, CC-309-1WS.
 - 7. Substitutions Section 01 2500 – Substitution Procedures.
- D. Sealing Compound: Hardener and dustproofers. Comply with VOC requirements specified in Section 018113 - Sustainable Design Requirements.
 - 1. US Spec; Permasil.
 - 2. The Euclid Chemical Company; Eucosil.
 - 3. W.R. Meadows; Med-Cure. L&M Chemicals; L&M Seal Hard.
 - 4. Substitutions Section 01 2500 – Substitution Procedures.
- E. Curing/Sealing Compound: ASTM C1315 Type 1, Class A 30% solids, clear without fugitive dye, waterborne membrane-forming curing and sealing compound. Comply with Federal Air Quality Regulations 40 CFR 52.254.
 - 1. The Euclid Chemical Company; Diamond Clear VOX.
 - 2. Dayton Superior; Cure & Seal 1315 EF.
 - 3. Creteseal; CS2000.
 - 4. US Spec; CS-30-1315.
 - 5. W.R. Meadows; CS 309-30.
 - 6. L&M Chemicals; Dress & Seal.
 - 7. Ashford Formula.
 - 8. Substitutions Section 01 2500 – Substitution Procedures.
- F. Evaporation Retarder: Waterborne, monomolecular, film forming for application to fresh concrete.
 - 1. Dayton Superior Corporation; Aqua Film J74/J74 RTU.
 - 2. US Spec; Monofilm ER.
 - 3. The Euclid Chemical Company; Eucobar.
 - 4. W.R. Meadows; EVAPRE - RTU.
 - 5. L&M Chemicals; E-CON. Substitutions Section 01 2500 – Substitution Procedures.
- G. Removable Curing Compound: Removable, VOC compliant curing compound designed to be easily removed by the application of a cleaner. ASTM C309, Type 1, Class B, for interior use only since wetting will negate its effectiveness.
- H. Removable Curing Compound: The Euclid Chemical Company; Kurez RC-100
- I. Cleaner: The Euclid Chemical Company; Kurez RC-off.
- J. Absorptive Mats: ASTM C171, cotton fabric or burlap-polyethylene, minimum 9 oz/sq yd bonded to prevent separation during handling and placing.
- K. Waterproof Paper: ASTM C171, curing paper treated to prevent separation during handling and placing, regular color.
- L. Polyethylene Film: ASTM C171, ASTM D2103, 6 mil, clear.
- M. Curing Covers:
 - 1. McTech Group, Inc.; Ultra Cure "NCF" or Ultra Cure "SUN" .
 - 2. PNA Construction Technologies; S16 Hydracure Covers for single-use or M5 for multi-use.

3. Substitutions Section 01 2500 – Substitution Procedures.

- N. Water: Potable, not detrimental to concrete.
2.3 HARDENER AND SEALER COMPOUNDS

- O. Approved Manufacturers:
1. Nox-Crete Products Group : Cure&Seal (Basis of Design).
 2. Davis Colors
 3. Euclid Chemical Co.
 4. L & M Construction Chemicals
 5. Master Builders Inc.
 6. Substitutions: Section 01 2500 – Substitution Procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.
- B. Verify surfaces are acceptable to receive the Work of this section.

3.2 CURING - HORIZONTAL SURFACES

- A. Cure concrete in accordance with ACI 308.1 using one of the following methods:
1. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.
 2. Spraying: Spray water (fog) over floor slab areas and maintain wet for 7 days.
 3. Absorptive Mat: Spread approved mat over floor slab areas. Spray with water until mats are saturated, and maintain in saturated condition for 7 days.
 4. Absorptive Mat: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place for 7 days.
 5. Membrane Curing Compound: Apply curing compound in compliance with manufacturer's written recommendations.
 6. Non-Membrane Forming Curing Compound: Apply curing compound in one coat. Maintain surface wet with curing compound, without ponding for time recommended by manufacturer.
 7. Polyethylene Film: Spread over floor slab areas, lap edges and sides, seal with pressure sensitive tape; maintain in place for 7 days.

3.3 PROTECTION OF FINISHED WORK

- A. Section 01 7000 – Execution and Closeout Requirements: Protecting Installed Construction.
- B. Do not permit traffic over exposed concrete floor surface or stair treads and landings.

3.4 SCHEDULE - CONCRETE FINISHES

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.
- B. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 2 percent slope or as indicated on Drawings.
- C. Exterior Flatwork: Light Broom Finish unless noted otherwise.
- D. Interior Exposed Vertical Concrete: Sack and Rub unless noted otherwise. Apply clear cure and seal to prevent dusting where indicated (columns, etc).

3.5 SCHEDULE - FLATWORK TOLERANCE

- A. Section 01 4000 - Quality Requirements: Tolerances.
- B. Measure for FF and FL tolerances for floors in accordance with ASTM E1155, within 72 hours after slab installation.
- C. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
 - 1. Slab-on grade areas covered with carpeting, or not specified otherwise in 2. below:
 - a. Specified overall value FF 25/FL 20
 - b. Minimum local value FF 17/FL 15
 - c. Level tolerance such that 80 percent of all points fall within a 3/4 inch envelope (+3/8 inch, -3/8 inch) from the design elevation.
 - 2. Slab-on grade areas that will be exposed, receive thin-set tile or resilient flooring:
 - d. Specified overall value FF 30/FL 20
 - e. Minimum local value FF 24/FL 15
 - f. Level tolerance such that 80 percent of all points fall within a 3/4 inch envelope (+3/8 inch, -3/8 inch) from the design elevation.
- D. Measurements: Owner retained testing laboratory will take measurements to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays included). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by testing laboratory.
- E. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.
- F. Unacceptable Work: Individual slab section measuring less than either of specified minimum local FF/FL numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall FF/FL numbers, then whole slab shall be rejected and remedial measures shall be required.
- G. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding. Patching of low spots is not permitted. Repair or removal and replacement of entire rejected slab areas, as directed by Architect, until a slab finish constructed within specified tolerances is accepted. Grinding shall be done as soon as possible, preferably within three days, but not until concrete is sufficiently strong to prevent dislodging of coarse aggregate particles.
- H. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

3.6 SCHEDULE - CURING AND SEALING

- A. In general cure concrete surfaces in accordance with ACI 301 (Refer to Schedule Curing). Apply compounds in accordance with manufacturer's instructions. Check for compatibility with finishes.
- B. Exterior Flatwork
 - 1. Curing compound with translucent color.

END OF SECTION

DIVISION 22

SECTION 220500
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

- A. Refer to Divisions 00 & 01 of these specifications, which govern work under Division 22. Refer to other sections of these specifications for additional related requirements.

1.2 SCOPE OF REQUIREMENTS

- A. The work covered by Division 22 of the specifications shall include but not limited to furnishing all materials and supplying all labor, equipment, and services to install the complete Division 22 systems as shown on the accompanying drawings and specified herein.
- B. Work done under Divisions 22 of the specifications shall comply with the requirements specified herein.

1.3 ALTERNATES (REFER TO DIVISION 00)

- A. The bid price for each alternate shall include a complete working Division 22 system as described in the alternates, shown on the drawings, and indicated in these specifications.

1.4 CODES, PERMITS AND FEES

- A. Division 22 work shall be in accordance with the following as adopted by the governing agencies, including amendments:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Applicable State and Local Codes and Ordinances
 - 3. National Electrical Code
 - 4. International Building Code
 - 5. International Fire Code
 - 6. International Mechanical Code
 - 7. Uniform Plumbing Code
 - 8. Washington State Non-Residential Energy Code
 - 9. Washington State Boiler and Unfired Pressure Vessel Code
 - 10. International Fuel Gas Code
- B. Permits and inspections required for the Division 22 work on this project shall be obtained as part of the Division 22 scope of work, and the cost for these permits and inspections shall be included in the Division 22 bid. All inspection certificates shall be delivered to the Owner's Representative prior to final acceptance of the work in accordance with the requirements of these specifications.
- C. All costs levied by utility companies and/or governing agencies associated with water, gas, sanitary and storm sewer connections shall be included in the Division 22 scope of work and shall be included in the Division 22 bid. This shall include but not limited to tap fees, service mains, meter and vault charges, valves, etc.
- D. Work shall comply with all regulations associated with all applicable utilities.

1.5 INTENT AND INTERPRETATIONS

- A. It is the intent of these plans and specifications to result in a complete and working Division 22 installation in complete accordance with all applicable codes and ordinances.
- B. The drawings and these specifications are intended to supplement each other. Any details contained in either the drawings or these specifications shall be included as if contained in both.

- C. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

1.6 DEFINITIONS

- A. The term "Acceptance", when used in Division 22, shall be defined as the Owner's assumption of ownership for part or all of the Division 22 system. Acceptance of part or all of the Division 22 system, when granted prior to completion of Division 22 work and/or correction of deficiencies, shall not relieve Division 22 of any responsibility for completion of this work and/or correction of these deficiencies.
- B. The term "Date of Acceptance", when used in Division 22, shall be the official date when Acceptance, as defined in these specifications, occurs. The Date of Acceptance shall be assumed to coincide with granting of Substantial Completion unless noted otherwise by the Owner's Representative. Deviation of the Date of Acceptance from Substantial Completion can assume to have occurred only when written documentation is provided by the Owner's Representative specifically indicating this separation and identifying an alternative designation for the Date of Acceptance.
- C. The terms "The Contractor" or "This Contractor", when used, shall be defined as the Contractor responsible for Division 22 work.
- D. The term "Owner's Representative", when used, shall refer to the Architect or his designated representative in accordance with Division 00 and 01.
- E. The term "Provide" shall mean furnish and install.
- F. The term "Mechanical", when used, to distinguish a particular scope of work or portion of the documents, shall mean the Division 22 scope of work and Division 22 documents (drawings and specifications) respectively.

1.7 DRAWINGS

- A. Plumbing/Mechanical drawings show general arrangement of piping, ductwork, equipment, etc. Drawings shall be followed as closely as actual building construction and work of other trades will permit.
- B. Architectural and Structural drawings and specifications shall be considered part of this work insofar as they furnish information relating to design and construction of the building. These documents take precedence over Division 22 drawings and specifications if any dimensional discrepancies exist.
- C. Division 22 drawings are diagrammatic only. Consequently, all required duct and pipe offsets are not indicated on the drawings. Offsets as required to meet the design intent of the drawings shall be provided.

1.8 GUARANTEE (REFER TO DIVISIONS 00 AND 01)

- A. The Division 22 equipment, materials, and installation shall be guaranteed for a period of one (1) year unless an individual item or specification is otherwise noted as longer. All defects in Division 22 work and/or equipment furnished that develop at any time during the one year guarantee period shall be corrected at no cost to the owner, including any expenses for cutting, patching, and repairing made necessary by corrections of unsatisfactory work and/or damage resulting from incorrect equipment operation.
- B. The guarantee period shall begin upon the Date of Acceptance. When Acceptance is granted for portions of the Division 22 system at different times, the guarantee for each portion of the Division 22 system shall begin upon Acceptance of that portion of the Division 22 system.
- C. Permission to use the permanent Division 22 system for temporary heating during construction does not constitute acceptance. All product and system warranties shall be extended at no cost to

the Owner as required to maintain this one (1) year requirement from the Date of Acceptance if such permission is given.

1. Exception: Use of part or all of the Division 22 system prior to the Date of Acceptance, when initiated by the Owner, shall constitute Acceptance of the specific piece of equipment and/or portion of the system only when acknowledgement of Acceptance is noted in written authorization from the Owner as required in these specifications.

- D. Equipment warranties in addition to this guarantee shall be provided in accordance with the table at the end of this section.

1.9 COST BREAKDOWN

- A. Refer to Divisions 00 and 01 for supplemental requirements.
- B. A breakdown of the plumbing construction cost shall be furnished to the Owner's Representative within 30 days of Notice to Proceed, with separate costs for each of the items listed in the cost breakdown identified in Part 4 at the end of this section.

1.10 PAYMENT REQUESTS

- A. Refer to Divisions 00 and 01 for supplemental requirements.
- B. Payment requests for materials and equipment will not be reviewed or approved until submittals and operation and maintenance data have been received and approved.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS – STANDARDS AND CODES

- A. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated "new" equipment is not acceptable. Each item of equipment and material shall conform to the latest Standard Specifications of the American Society for Testing Materials and shall conform to any applicable standards of the United States Department of Commerce.
- B. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to the Owner.
- C. Motor efficiencies shall meet or exceed the requirements of the applicable energy code.
- D. All electrically driven or connected equipment shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC.
- E. Equipment shall be UL listed as an assembly where listing/labeling program is available for that type of equipment.
- F. All control panels shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC and applicable local electrical codes.
- G. Fuel fired equipment shall be listed by a nationally recognized testing laboratory for use with the particular fuel type.
- H. All pressure vessels and relief valves shall be furnished in accordance with applicable State Boiler and Unfired Pressure Vessel Laws. This shall include rating and stamped in accordance with the ASME Boiler and Pressure Vessel Code where required by Code authorities or State Law.
- I. All piping, fittings, valves, fixtures, faucets and equipment containing or conveying potable water shall comply with the latest US Safe Drinking Water Act mandating any wetted surface of the above mentioned items shall not contain above 0.25% lead content by weighted average. All piping, fittings, valve and equipment containing or conveying potable water shall comply with NSF 61 G and NSF 372 or shall be provided with indication on submittals the manufacturer's declaration of self-certification.

2.2 EQUIPMENT/MATERIAL SUBSTITUTIONS

- A. Throughout these specifications and drawings, various materials, equipment, apparatus, etc., are specified or scheduled by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of design and the bid.
- B. Substitutions will not be permitted without written approval. (Refer to Divisions 00 and 01.)
- C. Where two or more manufacturer designations are listed in these specifications, choice will be optional with the Contractor except that where more than one manufacturer is listed and only one manufacturer's catalog number is specified or only one manufacturer scheduled on the drawings (basis of design), that standard of quality, dimensional characteristics, capacities, and construction shall be maintained by materials or equipment supplied by the other manufacturer(s).
- D. Substituted equipment with efficiencies less than 95 % of the basis of design efficiency shall not be considered equal to the basis of design.
- E. If the Division 22 Contractor uses manufacturers other than the basis of design, the Contractor shall be responsible for:
 - 1. Insuring the substituted item will fit the available space while allowing proper maintenance access
 - 2. Any changes required by other Contractors caused by the substituted equipment
 - 3. Changes in electrical requirements: See "Equipment Substitutions – Electrical Characteristics" below
 - 4. Changes in structural design due to weight differences
- F. In the event other than specified equipment is used and will not fit job site conditions, this Contractor shall assume responsibility for replacement with items indicated as the basis of design.

2.3 EQUIPMENT SUBSTITUTIONS – ELECTRICAL CHARACTERISTICS

- A. Products furnished other than the basis of design shall have similar electrical characteristics as the scheduled or specified equipment. The Contractor shall be responsible for any electrical changes caused by products not in accordance with this requirement.

2.4 SUBMITTALS FOR REVIEW

- A. Refer to Divisions 00 and 01 for supplemental requirements.
- B. Shop drawings, catalog information and material schedules shall be submitted for approval on all specified materials and equipment in Division 22 prior to ordering.
- C. Provide specific wiring diagrams for all equipment requiring electrical or control wiring. Upon approval, copies of these diagrams shall be forwarded to pertinent contractors.
- D. Furnish complete shop drawing/catalog data for equipment and materials to be used in the work for review. Allow sufficient time for developing shop drawings, processing and review time so that the installation will not be delayed.
- E. Shop drawings shall be reviewed, approved and stamped by the Contractor prior to submitting to Owner's Representative for approval. Submittals without such approval will be returned without review.
- F. Where choices of options and accessories are available or specified, provide written description of what is to be furnished. If necessary, list page numbers where submitted items are described.
- G. State sizes, capacities, brand names, motor horsepower, electrical characteristics, accessories, materials, gauges, dimensions, and other pertinent information.
- H. Underline applicable data.
- I. If material or equipment is not as specified or submittal is not complete, it will be rejected. Only complete submittal including all applicable specification sections will be reviewed.

- J. Field applied adhesives, sealants, fillers, primers, glues, and paint shall meet or exceed the requirements as identified in part 3 of this section.
- K. Provide cut sheets and a Material Safety Data Sheet (MSDS) for each field applied sealant, adhesive, coating, paint etc used in the building, highlighting VOC limits and chemical component limits. Also indicated in additional to actual VOC emissions identify allowed limits of each product to demonstrate compliance. Submit all proposed field applied products as a single submittal for review with their MSDS data.
- L. Catalog data or shop drawings for equipment which are noted as being reviewed shall not supersede Contract Documents.
- M. Review comments shall not relieve the Contractor from responsibility for deviations from Contract Documents unless attention has been called to such deviations in writing at time of submission, nor shall they relieve this Contractor from responsibility for errors in items submitted.
- N. Check work described by catalog data with Contract Documents for deviations and errors.
- O. Shop drawings and submittal information shall be provided for all required Division 22 equipment in a single submittal.
 - 1. Exceptions: At the discretion of the Owner's Representative, partial project submittals may be allowed.
- P. Submittal Format:
 - 1. Electronic submittals shall be provided with accordance with all of the following conditions. Electronic submittals which do not comply with all of these conditions will be rejected without review.
 - a. Electronic submittals shall be submitted in the current version of Adobe Portable Document Format (PDF)
 - b. Submittals shall be original PDF's of the document and shall not be created using scanned copies of paper documents.
 - c. PDF documents shall be searchable.
 - d. PDF documents shall be unlocked
 - e. Electronic submittals shall be separated by specification section and identified as such. Submittals which combine multiple sections into a single document will be rejected.
 - f. Electronic submittals shall include a table of contents and each applicable section shall be bookmarked for easy access.
 - g. Electronic submittals shall be clearly marked in RED using boxes and arrows and other appropriate markings to indicate specific product information, option selections, accessories, etc.
- Q. Each product shall be keyed to the paragraph number in the specifications.
- R. Operation and maintenance data for individual equipment shall also be provided subsequent to approval of equipment submittals in a separate binder meeting the same requirements as the submittal binder. Refer to Part 3 of this section for supplemental requirements.
- S. All submittals and re-submittals as required shall be provided with a cover page incorporating a table similar to that provided at the end of this section. The appropriate box(es) shall be checked on each line item for all submittals.

PART 3 - EXECUTION

3.1 LOCATIONS

- A. Coordination of Division 22 equipment and systems to the available space, with other trades and to the access routes through the construction shall be the Contractor's responsibility.
- B. Drawings are diagrammatic. Make offsets, transitions, and changes in direction of pipes and ducts as required to maintain proper head room and pitch of sloping lines and avoid structural, electrical,

pipe and duct interferences whether or not indicated on Drawings. Furnish fittings, etc., as required to make these offsets, transitions and changes in direction at no additional cost to the Owner.

- C. Pipe and duct routing shall be coordinated and verified with all trades prior to fabrication and installation. Additional project costs resulting from failure to do so shall be the Contractor's responsibility.
- D. Determine exact route and location of each pipe and duct and coordinate and obtain approval for changes from the layout indicated on the drawings with the Owner's Representative prior to fabrication.
- E. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Verify the physical dimensions of each item of Division 22 equipment to fit the available space and promptly notify the Owner's Representative prior to roughing-in if conflicts appear.
- F. All piping, wiring, equipment, ductwork, tubing, etc., shall be concealed within building construction unless otherwise noted, or in mechanical rooms.
- G. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, trap primers, starters, motors, control components, and to clear openings of doors and access panels.
- H. Existing Utilities and Piping
 - 1. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a 10 foot radius of the indicated location. Where connection points are not within this radius, the Contractor shall contact the Owner's Representative for a decision before proceeding or may proceed at his own expense.
 - 2. Connection points to existing work shall be located and verified prior to starting new work.
 - 3. Prior to commencing any excavation or ditching activity, the Contractor shall verify the exact location and inverts of all existing utilities and connection points in the area of his proposed excavation. Notify the Owner's Representative for further direction if actual inverts will not allow the proper installation of new work.
 - 4. The Contractor shall be responsible for damages which might be caused by his failure to exactly locate and preserve underground utilities.

3.2 SCHEDULING

- A. It is understood that while drawings are to be followed as closely as circumstances permit, the Contractor shall be responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Owner's Representative. Should conditions arise where certain changes would be advisable, secure approval from Owner's Representative for those changes before proceeding with work.
- B. The contractor shall coordinate with the work of various trades when installing interrelated work. Before installation of Division 22 items, proper provisions shall be made to avoid interferences. Changes required in work specified in Division 22 caused by neglect to do so shall be made at no cost to Owner.
- C. Supports and inserts in concrete required for Division 22 supports shall be furnished and installed in the Division 22 scope unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to those involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne under Division 22.

3.3 CUTTING AND PATCHING

- A. All cutting and patching of new and existing construction required for the installation of systems and equipment specified in Division 22 shall be the responsibility of the Division 22 Contractor. All

cutting shall be accomplished with masonry saws, drills or similar equipment to provide neat uniform openings.

- B. Walls, floors, ceilings and roof shall be patched and repaired with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials. All patching shall meet the approval of the Owner's Representative.
- C. All cutting and patching made necessary to repair defective equipment, defective workmanship or be neglect of this Contractor to properly anticipate his requirements shall be included in Division 22.
- D. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses or other structural members without the Owner Representative's written approval.
- E. Cutting, patching, repairing, and replacing pavement, sidewalks, roads, and curbs to permit installation of work specified or indicated under Division 22 is responsibility of Division 22.

3.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Refer to Divisions 00 and 01 for supplemental requirements.
- B. Follow manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.
- C. Promptly notify Owner's Representative in writing of conflicts between requirements of Contract Documents and Manufacturer's directions and obtain written instructions from Owner's Representative before proceeding with work. The Contractor shall bear expenses arising from correcting deficiencies of work that do not comply with manufacturer's directions or such written instructions from Owner's Representative.
- D. Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in a dry, heated space.
- E. Notify Owner of equipment delivery dates twenty-four (24) hours in advance of delivery.
- F. The Contractor shall be responsible for protection of equipment furnished in Division 22 from vandalism and weather during all phases of construction. Damaged equipment shall be restored to like new condition or replaced at the Contractor's expense.
- G. Any factory painted equipment scratched or marred during shipment or construction shall be restored to original "new" condition. This includes complete repainting if necessary to provide exact paint match.

3.5 VISITING THE PROJECT SITE

- A. The premises shall be examined and conditions shall be understood which may affect performance of work of Division 22 before submitting proposals for this work.
- B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions.

3.6 TESTS

- A. See individual specification sections for Testing Requirements.

3.7 EXCAVATION AND BACKFILL

- A. Comply with Division 31 and the requirements of this section.
- B. Provide all necessary excavation, shoring, bedding and backfilling required for the installation of work specified and indicated under Division 22. This shall include but not be limited to piping,

tanks, vaults, drywells, catch basins, manholes and other miscellaneous items inside building premises or outside as may be necessary.

- C. Compaction testing shall conform to ASTM D-1557 for cohesive soils and ASTM D-2049 for cohesionless soils.
- D. Requirements of Regulatory Agencies
 - 1. Proper approval shall be obtained in accordance with applicable City, County and/or State regulations.
 - 2. All safety regulations must be observed including applicable OSHA regulations.
- E. Existing Conditions
 - 1. A geotechnical investigation report may be available and included in the project manual for information only.
 - 2. Data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner or his representative will not be responsible for interpretations or conclusions drawn from this information.
- F. Protection
 - 1. Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations. Provide temporary utility services where necessary to maintain continuity of service. Provide minimum of seventy-two (72) hour notice to Owner prior to all utility interruptions. Remove existing utilities indicated to be removed. Where uncharted or incorrectly charted utilities are found, contact utility owner immediately for instructions.
 - 2. Protect structures, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations. Damage resulting from excavation operations shall be repaired by the Contractor at his expense.
 - 3. Slope sides of excavation to comply with State and local codes and ordinances. Shore and brace as required for stability of excavation. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Remove shoring and bracing when no longer required.
 - 4. Install sediment and erosion control measures in accordance with State and local codes and ordinances. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 °F.
 - 5. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
 - 6. Stockpile satisfactory excavated materials until required for backfill (place, grade, and shape stockpiles for proper drainage). Locate and retain soil materials away from edge of excavations. Remove and legally dispose of excess excavated materials and materials not suitable for use as backfill. Prevent spillage during hauling operations. In case of spills, clean streets, walks, etc. with power sweepers or as directed by the Owner's Representative.
- G. Excavate to uniform width, sufficiently wide to provide ample working room clearance on all sides of pipe, duct, tanks, and equipment. Excavate trenches to depth indicated or required for piping to establish indicated slopes and invert elevations. Where rock is encountered, carry excavation below required elevation and backfill with a minimum 6 inch layer of bedding material between rock bearing surface and pipe. At each pipe joint over-excavate to relieve the bell or pipe joint of pipe loads, and to ensure continuous bearing of pipe barrel on the bearing surface.
- H. Minimum trench width shall be the width of the pipe plus 16 inches or the pipe outside diameter times 1.25 plus 12 inches to allow adequate room for joining the pipe, snaking the pipe in the trench to allow for expansion and contraction where appropriate and space for backfilling and

compaction of backfill. The space between the pipe and the trench wall shall be wider than the compaction equipment used to compact the backfill.

- I. All pipe shall be laid on 6 inch minimum depth of bedding material.
- J. Bedding material shall consist of sand, sandy gravel or fine crushed gravel having a maximum size of $\frac{3}{4}$ inch. Place bedding material under and around the pipe to 6 inches above the top of the pipe. Distribute material in maximum layers of 6 inches and thoroughly compact by tamping. Take care to assure compaction under the haunches of the pipe. Note: pea gravel should not be used for pipe bedding.
- K. Bedding, backfill, and excavation for thermoplastic pipe (including PVC) shall additionally comply with the manufacturer's recommendations and with ASTM D-2321 (Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity Flow Applications).
- L. Where pipes pass under column or wall footings, or within the volume included by extending down from the edge of column or wall footings at a 45 degree angle, and top of pipe is within 2 feet 6 inches below the bottom of the footing, pipes shall be encased in either a steel sleeve or 6 inches of lean (1,500 psi, 28 day test) concrete all around the pipe, extending 5 feet beyond each side of the footing. Where the top of pipe is within 1 foot of the bottom of the footing, concrete encasement, if used, shall extend up to the bottom of the footing.
- M. Backfill excavations as promptly as work permits, but not until completion of inspection, testing and approval by authorities having jurisdiction, recording of locations of underground utilities, removal of concrete formwork, removal of shoring and bracing and backfilling of voids, and removal of trash and debris.
- N. Backfill material shall be free of cinders, ashes refuse, organic and frozen material, boulders or other unsuitable materials. Suitable material excavated from the trench or other suitable site material not containing rocks in excess of 6 inches in their maximum dimension shall be used for backfill in quantities available. Provide additional suitable material as needed to complete backfilling operations.
- O. Place backfill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Where layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- P. Do not place backfill material on surfaces that are muddy, frozen, or contain frost or ice. Place backfill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift. Compact carefully against foundation, basement and retaining walls so as not to create excessive pressure on walls.
- Q. Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below. Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D-1557, and not less than the following percentages of relative density, determined in accordance with ASTM D-2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - 1. Areas under Structures, Building Slabs, Steps, Pavement and Walkways: Compact each layer of backfill material to 90 % maximum density of cohesive material, or 95 % relative density for cohesionless material.
 - 2. Other Areas: Compact each layer of backfill material to 85 % maximum density for cohesive soils, and 90 % relative density for cohesionless soils.
 - 3. Where subsidence occurs at Division 22 installation excavations during the warranty period, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material,

compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

- R. Buried PVC/ABS Sanitary and Storm Sewer Pipe: Excavation, bedding, and backfill for buried PVC/ABS sanitary and storm sewer piping shall be in accordance with ASTM D2321.

3.8 COMMISSIONING SUPPORT

- A. The equipment and systems referenced in the Related Work section are to be commissioned per Division 1 and Division 22/23 commissioning specifications. The contractor has specific responsibilities for scheduling, coordination, startup, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.
- B. Include allowance in the bid to support commissioning. Allowance shall be a separate line item on the schedule of values.
- C. Include time for commissioning activities on the construction schedule to complete commissioning prior to substantial completion with the exception of seasonal testing which the commissioning agent determines should coincide with peak heating and cooling weather conditions.
- D. Related Work:
 - 1. Plumbing Mechanical - All Sections in Division 22.

3.9 CONSTRUCTION WASTE MANAGEMENT

- A. As part of the sustainable construction process, construction waste may be salvaged or re-used. This is a collaborative effort and should be coordinated with the General Contractor who is responsible for administration of the construction waste management plan.

3.10 PROJECT CLOSEOUT/OPERATION AND MAINTENANCE MANUAL

- A. Electronic submittals shall be provided with accordance with all of the following conditions. Electronic submittals which do not comply with all of these conditions will be rejected without review.
 - 1. Electronic submittals shall be submitted in the current version of Adobe Portable Document Format (PDF)
 - 2. Submittals shall be original PDF's of the document and shall not be created using scanned copies of paper documents.
 - 3. PDF documents shall be searchable.
 - 4. PDF documents shall be unlocked
 - 5. Electronic submittals shall be separated by specification section and identified as such. Submittals which combine multiple sections into a single document will be rejected.
 - 6. Electronic submittals shall include a table of contents and each applicable section shall be bookmarked for easy access.
 - 7. Electronic submittals shall be clearly marked in RED using boxes and arrows and other appropriate markings to indicate specific product information, option selections, accessories, etc.
 - 8. Each product shall be keyed to the paragraph number in the specifications.
- B. Cover page shall include:
 - 1. Job title
 - 2. Date
 - 3. Engineer
 - 4. Architect
 - 5. Contractor
 - 6. Construction Division
- C. Manual shall be organized into the following five sections:
 - 1. Contacts: This shall consist of name, address, and phone number of the following parties: Architect, Mechanical Engineer, Electrical Engineer, General Contractor, HVAC Contractor,

- Plumbing Contractor, Sheet Metal Contractor, Temperature Controls Contractor, Sprinkler Contractor, Electrical Contractor and major equipment suppliers.
2. Equipment
 - a. Begin the Equipment section with a separate sub-section containing a list of the Division 22 equipment indicating:
 - 1) Equipment name and designation as it appears on the equipment schedule
 - 2) Area served
 - 3) Manufacturer
 - 4) Model
 - 5) Serial number
 - 6) Name plate data
 - b. The remaining sub-sections shall include, at a minimum, the following for each item of Division 22 equipment. This material shall be organized in a separate tabbed sub-section for each section of the specifications. Within each sub-section, provide separate tabs for each item of equipment, referencing the equipment schedule designation. Provide the following information as applicable:
 - 1) Performance curves or tables showing the specified operating points and the operating points after final testing and balancing
 - 2) Manufacturer's maintenance instructions: Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, maintenance and lubrication instructions, troubleshooting guides, and overhaul specifications for major equipment.
 - 3) Step-by-step procedure to follow in putting each piece of Division 22 equipment into operation
 - 4) Wiring diagram for particular equipment item
 - c. Refer to individual specification sections for additional information required to be incorporated into the Operation and Maintenance Manual.
 3. Maintenance Schedule and Spare Parts
 - a. This shall include two sub-sections:
 - 1) The first sub-section shall consist of a preventative maintenance schedule summary table (or list). The table shall be organized by specification section and include:
 - a) Equipment name and designation as it appears on the equipment schedule
 - b) Equipment location
 - c) Type and frequency of preventative maintenance requirements (including lubrication)
 - 2) The second sub-section shall consist of a list of spare parts furnished under this contract. The list shall be organized by specification section and include (similar to that included at the end of this section):
 - a) Equipment name and designation as it appears on the equipment schedule
 - b) Spare part furnished
 - c) Verification by an Owner's Representative that the part(s) have been provided
 4. Warranties and Certifications
 - a. Shall include:
 - 1) Test and balance reports
 - 2) Test records of piping, tanks, etc
 - 3) Signed checklist of instruction period
 - 4) Certificate from Health Department indicating acceptance of domestic water quality
 - 5) Copies of specific product warranties
 - 6) Copies of certified factory start-up reports
 - 7) Valve tag identification schedules
 - 8) Copy of manual describing specific maintenance services that will be furnished under this contract
 - 9) Seismic Certification

- D. Prepare two (2) printed copies in three ring binders of approved manuals for use during the instruction period. Following instruction period, turn over both copies to the Owner's representative and the Owner.
- E. Manuals may be compiled in multiple volumes if necessary for ease of use.

3.11 PROJECT CLOSEOUT/OPERATION AND MAINTENANCE TRAINING

- A. General
 - 1. Two (2) training sessions shall be scheduled. The first shall occur after final inspection and prior to substantial completion. The second shall occur prior to the end of the first year of operation after acceptance. Training sessions shall be scheduled with the owner a minimum of two (2) weeks in advance.
 - 2. Instruct the Owner's representative(s) in operation and maintenance of Division 22 systems utilizing Operation and Maintenance Manual.
 - 3. Individuals present shall include the plumbing contractor, subcontractors and equipment factory representatives as appropriate. Certified factory representatives shall be present for all equipment requiring certified factory start-up.
 - 4. The contractor's representative performing the operation and maintenance training shall locate in the building each piece of equipment included in the O&M manuals, and shall instruct to the satisfaction of the owner's representative required operation and maintenance procedures as outlined in the O&M manuals.
 - 5. Provide a digital video of the training sessions conducted and furnish copies of the video to the Owner. Digital videos shall be of sufficient quality to allow training of future employees or refresher training of personnel. Use DVD format unless directed otherwise by the owner.
 - 6. Training shall occur after final inspection and prior to acceptance by owner. It shall be scheduled with the owner, and shall occur in one consolidated session for all Division 22 equipment.
 - a. Exceptions:
 - 1) Training for equipment requiring certified factory start-up shall be conducted at the time of start-up.
 - 2) Multiple sessions shall be scheduled as required to maintain a maximum allowable duration of any single session of four (4) hours.
 - 3) When separate training sessions are warranted to achieve proper training on all equipment and systems, as determined by the owner's representative, multiple sessions shall be scheduled as required.
 - 4) Training session shall include all equipment included in the table at the end of this section. A table similar to this one shall be used to verify owner training has been completed on all equipment, and shall be included in the Operation and Maintenance Manual.
 - 7. A second training session shall occur prior to the end of the first year of operation after acceptance. Prior to this session, the owner shall submit a list of items to be covered. This session shall include all parts of the first training session necessary to meet the satisfaction of the owner, up to and including full training of all equipment and systems.

3.12 PROJECT CLOSEOUT/SPARE PARTS/MAINTENANCE MATERIALS

- A. A list of spare parts to be provided under this contract has been included at the end of this section. Refer to individual specification sections for specific requirements of spare parts to be furnished under this contract.
- B. Turn spare parts and materials over to Owner.
- C. Provide summarized list of spare parts that have been furnished. List shall include verification by owner's representative that parts have been furnished. Incorporate into O&M Manual. Spare parts list shall be similar to that provided at the end of this section.

3.13 PROJECT CLOSEOUT/96-HOUR RUN TEST

- A. Refer to 23 05 00.

3.14 PROJECT CLOSEOUT/PRE-BALANCE REQUIREMENTS

- A. Assist test and balance agency, complete pre-balance checklists and attend pre-balance conference in accordance with Section 23 05 00.

3.15 PROJECT CLOSEOUT/WARRANTIES

- A. Provide specific equipment/material warranties that extend beyond 1 year project warranty period.
 - 1. Refer to individual specifications sections for required extended warranties.
 - 2. Incorporate extended warranties into O&M Manual in warranties section.

3.16 PROJECT CLOSEOUT/FINAL CLEANING

- A. Clean up all equipment, materials, cartons and other debris that is a direct result of the installation of equipment under this contract.
- B. Clean exposed piping, equipment, and fixtures. Repair damaged finishes and leave everything in working order.
- C. Remove stickers from fixtures and adjust flush valves.

3.17 PROJECT CLOSEOUT/RECORD DRAWINGS

- A. Provide in accordance with Division 01 and the requirements of this section.
- B. Record differences between mechanical work as installed and as shown in Contract Documents on a set of prints of mechanical drawings to be furnished by Owner's Representative. Return these prints to the Owner's Representative at completion of Project Notations made on drawings shall be neat and legible. These drawings shall not be used for any other purposes.
 - 1. Coordination drawings and fabrication drawings may not be utilized as record drawings unless:
 - a. Content from original drawings set such as notes and keynotes are transferred over to the coordination and fabrication drawings.
 - b. Drawings shall not be multidiscipline (ie plumbing and HVAC on same sheet) unless prepared that way in the construction documents.
 - c. Drawings clearly identify deviations/modifications to the construction documents.
- C. Refer to individual specification sections for additional requirements.

3.18 PROJECT CLOSEOUT/PUNCH LIST PROCEDURES

- A. The Contractor shall notify the Owner's Representative in writing when the project is ready for punch lists. The following items must be complete before punch list will be performed, and must be provided with written verification:
 - 1. Systems are complete and functional, including controls and control interface with 23 09 23 control systems when specified or indicated on drawings.
 - 2. Testing and balancing is complete, and test and balance reports have been submitted for review.
 - 3. Operation and Maintenance Manuals are complete, and have been submitted for review.
- B. After punch lists are complete, written notice must be forwarded to the Owner's Representative requesting final checkout. Any additional trips beyond the final checkout required due to incomplete items on previous punch lists will be billed to the Contractor at normal rate plus travel expenses.
- C. At the time of initial and final observation, the project foreman shall accompany the observation party and shall remove access panels and perform other duties, as required, to allow complete observation of the entire Division 22 system.

3.19 PROJECT CLOSEOUT/MAINTENANCE SERVICES

- A. Provide a separate manual describing specific maintenance services to be provided under this contract as required under specific specification sections.

PART 4 - TABLES

4.1 COST BREAKDOWN

- A. Provide breakdown for the categories that follow. Each category shall identify separate costs for material and labor/installation.
- B. Category:
 - 1. Mobilization
 - 2. Supervision
 - 3. Site Utilities
 - 4. Plumbing Rough-in
 - 5. Plumbing Equipment (floor drains, roof drains, water hammer arrestors, valves, hot water tanks etc)
 - 6. Plumbing Insulation
 - 7. Commissioning Assistance

END OF SECTION

SECTION 220505
ADDITIONS OR REMODELED FACILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Phased Remodel Construction in Existing Occupied Buildings
- B. Additions to existing occupied buildings
- C. Hazardous material control within existing buildings
- D. Demolition and salvage within existing buildings

1.2 RELATED SECTIONS

- A. Section 22 05 00 – Common Work Results for Plumbing

1.3 PERFORMANCE REQUIREMENTS

- A. All systems shall be fully operational to the extent that they are installed at the termination of each phase of the work.
- B. System piping passing through existing, future, or other phase areas shall be installed, if required, to make work installed under the current phase operational.
- C. Contractor shall notify the Owner a minimum of seventy-two (72) hours in advance of any disruption to utility distribution systems.
- D. All connections to and disconnections from existing utilities such as water shall be coordinated with and approved by the Owner prior to proceeding with the work. Work shall be planned so as to minimize impact to areas not involved in ongoing construction. Where areas are not involved in ongoing construction are to be impacted, the contractor shall identify such areas, the extent to which they will be affected and the period of time for which they will be affected. Provide required temporary mechanical connections to accommodate the nature of this work.
- E. The contractor is advised that the above notification and scheduling requirement may necessitate rescheduling, partial completion and reconnection, overtime work at night or on weekends or delay of the work. Contractor costs incurred due to the above shall be included in the original bid price and shall not be the cause for additional claims or charges to the Owner.
- F. All new piping shall be installed, cleaned, tested, and sterilized (domestic water) prior to making connections to existing systems.
- G. Prior to connecting new domestic water piping to existing water piping, contractor shall test the existing domestic water to ensure it meets applicable health department standards. If this water quality is in non-compliance, contractor shall contact Owner's Representative for further direction. After connection of new and existing systems, Contractor shall be responsible for ensuring entire system meets Health Department water quality standards. The intent of this specification is to identify latent and unanticipated conditions.
- H. Small potable water piping additions may be sterilized by cleaning with chlorine solution prior to installation and flushing after installation. Certificate of approval from Health authority on entire system must be obtained.

1.4 HAZARDOUS MATERIAL CONTROL

- A. Specific attention is directed to the potential of asbestos bearing or other hazardous compounds and materials on the project. Careful coordination with other Contractors and reasonable care shall be exercised.

- B. If asbestos bearing or hazardous compounds or materials are encountered during the course of construction, the Contractor shall immediately notify the General Contractor/Owner's representative and wait for direction.
- C. Extent of Asbestos:
 - 1. It can be assumed that the Owner will have removed all asbestos from the construction area of this project prior to this contract.

1.5 DEMOLITION AND SALVAGE

- A. Demolition of existing mechanical systems and equipment in remodeled areas shall be provided under Mechanical.
- B. The Owner reserves first right of refusal for all materials and equipment designated for demolition or removal. All items refused by the Owner shall salvage to the Contractor.
- C. Systems and equipment to be removed and salvaged to the Contractor shall be removed from the site.
- D. Equipment and materials salvaged to the Owner shall be delivered to the Owner at on-site location.
- E. Visit the site prior to the bid date to determine the extent of required demolition.
- F. Schedule removal with the general contractor and sequence with other construction activities.
- G. If only portions of existing mechanical systems are indicated to be removed, Contractor shall cap piping flush with walls, floors, or ceilings to allow for refinishing (where applicable).

1.6 CUTTING AND PATCHING

- A. Refer to Section 22 05 00.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION

SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sleeves

1.2 RELATED SECTIONS

- A. Division 7 - Thermal and Moisture Protection
- B. Section 22 05 00 - Common Work Results for Plumbing
- C. Section 22 05 23 - General Duty Valves for Plumbing Piping
- D. Section 22 05 48 - Vibration Controls for Plumbing Piping and Equipment
- E. Section 22 05 49 - Seismic Controls for Plumbing Piping and Equipment
- F. Section 22 07 00 - Plumbing Insulation
- G. Section 22 10 00 - Plumbing Piping

1.3 SUBMITTALS FOR REVIEW (REFER TO SECTION 22 05 00)

- A. Product Data: Provide manufacturers catalog data.
- B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Sleeves for Pipes through Non-fire Rated Floors: 18 gauge thick galvanized steel.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gauge thick galvanized steel.
- C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed, refer to Division 7. Sleeves for below grade piping passing under footings: Class 52; ductile iron.
- D. Sleeves for below grade piping passing through exterior walls - Mechanical Rubber Pipe Seals.
- E. Stuffing Insulation: Glass fiber type; non-combustible; 3 lb. density.
- F. Fire Safeing Sealant: Intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures beginning at 250 °F. It shall have ICBO, BOCA I approved ratings to 3 hours per ASTM E814 (UL 1479). 3M Fire Barrier Caulk, Putty, strip and sheet forms.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 SLEEVES

- A. Provide sleeves for above grade piping penetrations of walls, roofs and floors.
- B. See drawings and details for pipe sleeves.
- C. Set sleeves in position in formwork. Provide reinforcing around sleeves.

- D. Size sleeves large enough to allow for movement due to expansion and contraction but not less than (2) pipe sizes larger than piping run. Provide for continuous insulation wrapping, where required.
- E. Where piping penetrates a roof, floor or wall, close off space between pipe and sleeve with 3 lb. Fiberglass insulation and elastomeric Sealant (air tight). This applies to all roofs, walls or floors regardless of fire rating. Refer to Division 7. Note: 3 lb. insulation not required at roof penetrations. Use fire safeing sealant at penetrations of fire rated floors and walls.
- F. Provide chrome plated cast brass, one piece escutcheons at all pipe penetrations of finished surfaces (walls, ceilings, floors). Provide security set screw.
- G. Furnish and install waterproof sleeves on all piping penetrations through the floor slabs in mechanical room floor or any area where pipes pass through slabs where water spillage could cause damage to ceilings below. Top of sleeve shall extend 2 inches above floor.
- H. Sleeves are not required for core drilled holes.

END OF SECTION

SECTION 220523

GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General Valves
- B. Temperature and Pressure Relief Valves
- C. Strainers
- D. Access Doors

1.2 RELATED SECTIONS

- A. Division 8 – Access doors
- B. Section 22 05 00 – Common Work Results for Plumbing
- C. Section 22 05 53 – Identification for Plumbing Piping and Equipment
- D. Section 22 07 00 – Plumbing Insulation
- E. Section 22 10 00 – Plumbing Piping

1.3 REFERENCES

- A. General Valves
 - 1. MSS SP-67 - Butterfly Valves
 - 2. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends
 - 3. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends
 - 4. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends
 - 5. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves
 - 6. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
 - 7. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.4 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Section 22 05 00.
- B. Product Data: Provide data on materials, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.

1.6 REGULATORY REQUIREMENTS

- A. All piping, fittings, valves, fixtures, faucets and equipment containing or conveying potable water shall comply with the latest US Safe Drinking Water Act mandating any wetted surface of the above mentioned items shall not contain above 0.25% lead content by weighted average. All piping, fittings, valve and equipment containing or conveying potable water shall comply with NSF 61 G and NSF 372 or shall be provided with indication on submittals the manufacturer's declaration of self-certification.

1.7 DELIVERY, STORAGE, AND HANDLING (REFER TO SECTION 22 05 00)

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 DRAWING SCHEDULES

- A. Refer to schedules on drawings for model numbers, symbols, etc. for additional information concerning products specified in this section.

PART 2 - PRODUCTS

2.1 GENERAL VALVES

- A. Manufacturers (Refer to Section 22 05 00):
 - 1. Crane
 - 2. Jenkins
 - 3. Powell
 - 4. Milwaukee
 - 5. Grinnell
 - 6. Stockham
 - 7. Hammond
 - 8. Nibco
 - 9. Walworth
 - 10. Watts
- B. Gate Valves
 - 1. Up to and including 2 inches:
 - a. MSS SP-80, Class 125, bronze body, bronze trim, non-rising stem, handwheel, inside screw, solid wedge disc, solder or threaded ends
 - 2. 2½ inches and larger:
 - a. MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor—OS&Y.
- C. Globe Valves
 - 1. Up to and including 2 inches:
 - a. MSS SP-80 Class 150, bronze body, bronze trim, handwheel, Teflon disc, solder or threaded ends
 - 2. 2½ inches and larger:
 - a. MSS SP-85 Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.
- D. Ball Valves
 - 1. Up to and including 3 inches:
 - a. MSS SP-110, Class 150, 400 psi, bronze two piece body, chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with union.
- E. Butterfly Valves
 - 1. 2 inches and larger:
 - a. MSS SP-67, 200 psi, bronze body, 316 stainless steel disc, resilient replaceable Buna N seat, wafer or lug ends, extended neck, stainless steel stem, infinite position lever handle with memory stop. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.2 TEMPERATURE AND PRESSURE RELIEF VALVES

- A. Temperature and Pressure Relief:
 - 1. Manufacturers (Refer to Section 22 05 00):
 - a. Watts
 - b. Wilkins
 - c. Bell & Gossett
 - 2. Tested under ANSI Z21.22 with ratings as certified and listed by A.G.A. and C.G.A., bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 °F, capacity ASME SEC IV certified and labeled.

2.3 STRAINERS

- A. Up to 2 inches:
 - 1. Manufacturers (Refer to Section 22 05 00):
 - a. Watts
 - b. Wilkins
 - c. Spirax Sarco
 - 2. Threaded brass body for 125 psi, at 400 °F, Y pattern with 3/64 inch stainless steel perforated screen
- B. 2½ inches to 4 inch:
 - 1. Manufacturers (Refer to Section 22 05 00):
 - a. Watts
 - b. Wilkins
 - 2. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen
- C. 5 inches and larger:
 - 1. Manufacturers (Refer to Section 22 05 00):
 - a. Watts
 - b. Wilkins
 - 2. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen

2.4 ACCESS DOORS

- A. Materials shall be in accordance with Division 8.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove scale and dirt, on inside and outside, before assembly.

3.2 INSTALLATION – GENERAL

- A. Provide valves in accordance with manufacturer's instructions and as indicated on the drawings.
- B. Allow for sufficient space above removable ceiling panels to allow for ceiling panel removal.
- C. Provide clearance from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
- D. Provide access doors where valves, strainers, regulators etc., are not exposed unless indicated to be provided under other divisions. Access doors shall comply with Division 8.
- E. Install valves with stems upright or horizontal, not inverted.
- F. Install water and gas solenoid valves with the solenoid in the upright position.
- G. Valves shall be line size unless indicated otherwise.

3.3 APPLICATION

- A. Provide ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers. Note: Ball valves shall be limited to pipe sizes 2 inches and smaller.
- B. Provide globe, ball or butterfly valves for throttling, bypass, or manual flow control services.
- C. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment, for pressure reducing valves and meters as indicated on drawings.
- D. Provide spring loaded check valves on discharge of domestic water booster pumps. Provide swing checks for other water applications.
- E. Provide listed gas shutoff valves in natural and propane gas systems for shut-off service and at all equipment connections.
- F. Provide flow control balance valves (circuit setters) in domestic hot water recirculating systems where indicated.
- G. Provide gate valves for main domestic water shutoff.
- H. Provide isolation shutoff valves and unions at inlet and outlet sides of all water pressure reducing valves, water/gas solenoid valves and gas pressure regulators.
- I. Provide ball check valves on the discharge of sewage ejectors and sump pumps and where indicated in storm and waste water systems.

END OF SECTION

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Inserts
- B. Pipe Hangers and Supports
- C. Pipe Insulation Shields
- D. Resilient Clamps
- E. Equipment Supports

1.2 RELATED SECTIONS

- A. Division 3 - Cast In Place Concrete
- B. Division 7 - Thermal and Moisture Protection
- C. Section 22 05 00 –Common Work Results for Plumbing
- D. Section 22 05 23 – General Duty Valves for Plumbing Piping
- E. Section 22 05 49 – Seismic Controls for Plumbing Piping
- F. Section 22 07 00 – Plumbing Insulation
- G. Section 22 10 00 – Plumbing Piping

1.3 REFERENCES

- A. General
 - 1. ASME B31.9 - Building Services Piping
- B. Pipe Hangers and Supports
 - 1. ASTM F708 - Design and Installation of Rigid Pipe Hangers
 - 2. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer
 - 3. MSS SP69 - Pipe Hangers and Supports - Selection and Application
 - 4. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.4 SUBMITTALS FOR REVIEW (REFER TO SECTION 22 05 00)

- A. Product Data: Provide manufacturers catalog data including load capacity.
- B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULATORY REQUIREMENTS

- A. Pipe Hangers and Supports
 - 1. Hanger and support systems shall conform to MSS SP58, MSS SP69, MSS SP89

1.6 RELATED WORK SPECIFIED IN OTHER SECTIONS

- 1. Supports for Medical Gas and Vacuum Systems: refer to section 22 60 01.

PART 2 - PRODUCTS

2.1 INSERTS

- A. Construction: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment; top slot for reinforcing rods; lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

- A. Manufacturers (Refer to Section 22 05 00):
 - 1. Grinnell/Anvil
 - 2. ERICO/Michigan Hanger
 - 3. Crane
 - 4. Fee and Mason
- B. Plumbing Piping – Water (Copper/Steel Pipe):
 - 1. Conform to MSS SP58, MSS SP69, and MSS SP89.
 - 2. Hangers for Pipe Sizes ½ to 1½: Carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Cold Pipe Sizes 2 inches and over: Carbon steel, adjustable, clevis.
 - 4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
 - 5. Hangers for Hot Pipe Sizes 6 inches and over: Adjustable steel yoke, cast iron roll, double hanger.
 - 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 7. Multiple or Trapeze Hangers for Hot pipe Sizes 6 inches and over: Steel channels with welded spacers and hanger rods, cast iron roll.
 - 8. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
 - 9. Wall Support for Pipe Sizes 4 inches and over: Welded steel bracket and wrought steel clamp.
 - 10. Wall Support for Hot Pipe Sizes 6 inches and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 - 11. Vertical Support: Steel riser clamp.
 - 12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 13. Floor Support for Hot Pipes to 4 inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 14. Floor Support for Hot Pipe Sizes 6 inches and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 - 15. Swivel ring, clamps and all materials in contact with the pipe shall be plated to match copper pipe material.
- C. Pipe Riser Clamps
 - 1. Steel and Cast Iron Pipe: Extension pipe or riser clamp; carbon steel; black or galvanized finish.
 - a. Basis of design: Grinnell Fig 261.
 - 2. Copper Pipe: Copper tubing riser clamp; carbon steel; copper finish.
 - a. Basis of design: Grinnell Fig CT-121.

2.3 HANGER RODS

- A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.4 PIPE INSULATION SHIELDS

- A. Manufacturers (Refer to Section 22 05 00):
 - 1. Grinnell
 - 2. Fee & Mason
 - 3. M-Co

- 4. Pipe Shields, Inc.
- 5. Kin-Line
- B. Hot Piping (insulated pipe, 2 ½" and larger): Protection saddle type; size to suit thickness of insulation; curved carbon steel plate; Grinnell Fig 160, 161, 162.
- C. Hot Piping (up to 2"): Insulation protection shield type; carbon steel; galvanized finish; Grinnell Fig 167.
- D. Cold Piping: Insulation protection shield type; carbon steel; galvanized finish; Grinnell Fig 167.

2.5 RESILIENT CLAMPS

- A. Manufacturers (Refer to Section 22 05 00):
 - 1. Hydra-Zorb
- B. Construction: Resilient cushion with clamps and anchoring channel.

2.6 PIPE SUPPORTS-STRUT CHANNEL SUPPORT STANDS

- A. Manufacturers (Refer to Section 22 05 00)
 - 1. Unistrut
 - 2. MAPA
 - 3. Miro Industries
- B. Polycarbonate base with carbon black pigment for UV resistance or stainless steel base as required for load. Rounded edges to prevent gouging of roof membrane.
- C. Base for supports shall be single base, double base or heavy duty double base trapeze as required for weight/duty of pipe supports.
- D. Supports shall hot dipped galvanized and have adjustable heights. Heights shall allow for mounting of pipe and equipment above snow levels. Supports shall allow for single or multiple pipes in for single tier or multiple tier installations
- E. All thread shall be stainless steel with size to support weight of supported pipe or equipment.
- F. This support is not to be used where seismic and wind restraints are required. Refer to 22 05 49.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Piping shall be installed in such a manner that it is not in contact with metal building components.
- C. Provide neoprene or approved wrap between water piping and metal building components, unistrut or other metal.
 - 1. Exceptions:
 - a. Not required where piping is isolated from hangers with insulation shields.
 - b. Not required where resilient clamps are used.
- D. Concrete housekeeping pads for mechanical equipment are not under Mechanical. Coordinate required location and size with other divisions and provide equipment shop drawings for proper sizing.
- E. Provide templates, anchor bolts, and accessories for mounting and anchoring to other divisions as applicable.
- F. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- G. Provide rigid anchors for pipes after vibration isolation components are installed.

3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab in concealed areas and recessed into and grouted flush with slab in exposed areas.

3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping in accordance with applicable codes and the table at the end of this section.
- B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.
- C. Place hangers within 12 inches of each horizontal elbow.
- D. Use hangers with 1½ inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide copper plated hangers and supports for copper piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. (Refer to division 9). Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- K. Support vertical piping at every floor penetration with pipe riser clamps.
- L. Support vertical cast iron pipe at each floor at hub.
- M. Support risers independently of connected horizontal piping.
- N. Provide vibration isolation at supports when required by Section 23 05 48.
- O. Provide seismic bracing for pipes as required. Refer to Section 23 05 49.
- P. Install piping on "Roof Pipe Supports". See details on plans. Where not detailed on plans, provide roof pipe supports as specified herein.

3.4 PIPE INSULATION SHIELDS

- A. Provide shields to protect pipe insulation at hangers. (Furnished and installed under Section 22 05 29.)
- B. Size hangers to accommodate pipe insulation and insulation shields where applicable. See Section 22 07 00.

3.5 PIPE INSULATION INSERTS

- A. Furnished under Section 22 07 00, installed under Section 22 05 29.

3.6 RESILIENT CLAMPS

- A. Use to attach tubing, pipe, or hoses to vibrating machinery or equipment.
- B. Use to isolate piping from contact with other metals, steel partition studs.

PART 4 - TABLES

Pipe Size (inches)	Max. Horizontal Spacing for Hangers (feet)			Hanger Rod Dia. (inches)
	Threaded or Welded Joints		Copper Tube and Piping (soldered, brazed or welded joints)	
	Steel (excluding gas)	Steel (gas)		
1/2	10	6	6	3/8
3/4	10	8	6	3/8
1	10	8	6	3/8
1 1/4	10	10	6	3/8
1 1/2	12	10	6	3/8
2 to 3	12	10	10	1/2
4 to 6	12	10	10	5/8
8 to 12	12	10	10	7/8
Notes:				
1. For other piping Materials, support in accordance with the requirements of the Uniform Plumbing Code and the manufacturer's requirements.				

END OF SECTION

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SECTION 220549

SEISMIC CRITERIA FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section documents the seismic criteria that apply to this project
- B. Seismic controls are not required for the division 22 systems provided in this project.

1.2 QUALITY ASSURANCE

- A. Unless otherwise directed by the local authority having jurisdiction, the following codes and standards apply:
 - 1. International Building Code 2015
 - 2. American Society of Civil Engineers Standard ASCE 7-10

1.3 SEISMIC CRITERIA

- A. Seismic Factors: for more details consult structural plans
 - 1. Seismic Design Category: C
 - 2. Risk Category: II
- B. For other Seismic Criteria, such as Site Specific Site Soil Class (Mapped Seismic Acceleration (SS), Mapped spectral response acceleration at 1 second period (S1), Seismic Use Group, see the structural drawings.
- C. Mechanical System Importance Factor:
 - 1. Risk Category II
 - a. All Division 22 Pipe, Systems and Equipment, Ip=1.0
- D. In accordance with the International Building Code, the following Seismic Design Categories are exempt from Seismic Bracing of pipe, duct and equipment:
 - 1. Seismic Design Category C (SDC-C) for equipment with Ip=1.0

END OF SECTION

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SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates
- B. Pipe Markers
- C. Tags
- D. Tag Chart

1.2 RELATED SECTIONS

- A. Section 22 05 00 – Common Work Results for Plumbing
- B. Mechanical Piping, Valves, Equipment, and Control Sections

1.3 REFERENCES

- A. ASME A13.1 - Scheme for the Identification of Piping Systems

1.4 SUBMITTALS FOR REVIEW (REFER TO SECTION 22 05 00)

- A. Submit list of wording, symbols, letter size, and color coding for mechanical identification of all systems and equipment.
- B. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.

1.5 OPERATION AND MAINTENANCE MATERIALS (REFER TO SECTION 20 10 06)

- A. Include valve tag identification schedule.

1.6 REGULATORY REQUIREMENTS

- A. Conform to Uniform Plumbing Code (Section 601) for signage and labeling requirements for potable and non-potable water systems.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved white letters on black background
 - 1. Exception: Nameplates for labeling non-potable outlets shall be posted with black uppercase lettering on a white background.

2.2 PIPE MARKERS

- A. Manufacturers: (Refer to Section 22 05 00):
 - 1. W.H. Brady
 - 2. Seton
 - 3. Marking Services, Inc.
- B. Color and Lettering: Conform to ASME A13.1, Uniform Plumbing Code Section 601, and WSU Campus Standards.

- C. Markers shall identify fluid or gas type, have colored bands with background color in spacing required in Part 3, and the direction of normal flow.
 - 1. Potable water systems shall have green background with white letters.
 - 2. Non-Potable systems shall have yellow background with black uppercase lettering with the words "CAUTION: NONPOTABLE WATER, DO NOT DRINK."
 - 3. Minimum color field length and minimum letter size per the Uniform Plumbing Code.
- D. Plastic Pipe Markers: Factory fabricated; flexible; semi-rigid plastic; preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- F. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape; minimum 6 inch wide by 4 mil thick; manufactured for direct burial service. Provide metallic tracer wire imbedded in tape on non-metallic piping systems.

2.3 TAGS

- A. Description: Brass or Aluminum with stamped letters; tag size minimum 1½ inch diameter with smooth edges. Provide ¼" letters for piping system abbreviation and ½" sequenced numbers. Provide 1/8" hole for fastener.

2.4 TAG CHART

- A. Description: Typewritten letter size list in aluminum frame, plastic laminated. Chart shall include valve number, service and location.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturer's recommendations.

3.2 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Provide identifying devices after completion of coverings and painting.

3.3 NAMEPLATES/LABELS

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- B. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- C. Non-potable system water outlets and equipment connected to non-potable water supply shall be posted with "CAUTION: NON-POTABLE WATER, DO NOT DRINK."

3.4 PIPE MARKERS

- A. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe. Provide metallic tracer wire imbedded with pipe markers for non-metallic piping systems.

3.5 TAGS

- A. Install tags using corrosion resistant chain. Number tags consecutively by location.

3.6 SCHEDULE

- A. Identify all scheduled equipment (pumps, heat transfer equipment, tanks, compressors etc.) and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- B. Identify control panels and major control components outside panels with plastic nameplates.
- C. Identify valves in main and branch piping with tags. Exception: check valves, valves with factory-fabricated equipment units.
- D. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow direction, and pressure (when applicable). Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (but not less than one per room) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- E. Provide tagged valve schedule (individual to each building) to the owner.

END OF SECTION

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SECTION 220700

PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Equipment Insulation
- B. Inserts and Shields – Installation
- C. Jackets and Fitting Covers

1.2 RELATED SECTIONS

- A. Section 22 05 00 – Common Work Results for Plumbing
- B. Section 22 05 17 – Sleeves and Sleeve Seals for Plumbing Piping
- C. Section 22 05 23 – General Duty Valves for Plumbing Piping
- D. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- E. Section 22 05 53 – Mechanical Identification
- F. Section 22 10 00 – Plumbing Piping

1.3 REFERENCES

- A. General
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
 - 3. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
 - 4. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials
- B. Glass Fiber
 - 1. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation
- C. Jackets and Fitting Covers
 - 1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 2. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
 - 3. ASTM D1784 - Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds Chlorinated Polyvinyl Chloride (CPVC) Compounds

1.4 SUBMITTALS FOR REVIEW (REFER TO SECTION 22 05 00)

- A. For each insulation type, provide material characteristics, minimum and maximum service temperatures, moisture absorption characteristics, thermal and vapor transmission characteristics.
- B. Provide a schedule indicating insulation type and thickness for all pipe sizes of all piping systems.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and who is authorized by the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products in accordance with Section 22 05 00.

- B. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of twenty-four (24) hours.

1.8 REGULATORY REQUIREMENTS

- A. Conform to flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, and UL 723. This shall apply to insulation as well as to all accessories including but not limited to adhesives, mastics, jackets, cements, tapes, cloth for fittings, etc.

PART 2 - PRODUCTS

2.1 GLASS FIBER INSULATION (PIPING)

- A. Manufacturers (Refer to Section 22 05 00):
 - 1. Johns Manville, Micro-Lok, AP-T Plus
 - 2. Knauf
 - 3. Owens Corning
- B. Insulation: ASTM C547; rigid molded; noncombustible; *k* factor: ASTM C177, 0.24 Btu·in/(h·ft²·°F) at 75 °F; 850 °F maximum service temperature; 0.2 percent maximum moisture absorption by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn; bonded to aluminized film with pressure sensitive tape lap sealing system; moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- D. Provide with GreenGuard Certification for Children and Schools.

2.2 JACKETS AND FITTING COVERS (PIPING)

- A. PVC Plastic Jacket and Fitting Covers (Interior Applications):
 - 1. Manufacturers (Refer to Section 22 05 00):
 - a. Zeston 2000
 - 2. Jackets and fitting covers: ASTM D1784; one piece molded type fitting covers and sheet material; off-white color; minimum service temperature: 0 °F; maximum service temperature: 450 °F; thickness: 20 mil.
 - 3. Jackets and fitting covers (vapor barrier jackets): ASTM D1784; one piece molded type fitting covers and sheet material; off-white color; minimum service temperature: 0 °F; maximum service temperature: 450 °F; moisture vapor transmission - ASTM E96 - 0.002 perm-inches; thickness: 20 mil.
 - 4. Connections: Pressure sensitive color matching vinyl tape
- B. Aluminum Jacket (Exterior Applications): ASTM B209
 - 1. Manufacturers (Refer to Section 22 05 00):
 - a. Childers
 - b. Pabco
 - 2. Jacket: Thickness: 0.016 inch sheet; finish: smooth; joining: Longitudinal slip joints and 2 inch laps.
 - 3. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.3 INSERTS AND SHIELDS

- A. Inserts: Heavy density insulation which will not crush from weight of pipe. Locate between shield and pipe. Inserts are furnished in this Section 22 07 00 and installed in Section 22 05 29.

- B. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and insulation. Shields are furnished and installed under Section 22 05 29.

2.4 REUSABLE VALVE COVERS (PIPING)

- A. Manufacturers (Refer to Section 22 05 00):
 - 1. No Sweat Valve Wraps
- B. Insulation shall have a minimum k- factor .26, using fiberglass blanket. Flame and smoke spread shall be 25/50 per ASTM E-84.
- C. Outer jacket shall be made of material equal to DuPont Tychem® QC, overlapping and completely covering the insulation with seams joined by tabs made from hook and loop fasteners (Velcro). Butt ends shall have sewn- in-place elastic.
- D. Outer jacket shall overlap adjoining sections of pipe insulation.
- E. Installation shall not require the use of any special hand tools.
- F. Suitable for continuous operation at 200 degrees Fahrenheit.

PART 3 - EXECUTION

3.1 EXAMINATION – GENERAL

- A. Verify that piping has been tested and approved before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION – GENERAL (PIPING)

- A. Continue insulation with vapor barrier through penetrations.
- B. On exposed piping in finished areas, locate insulation and cover seams in least visible locations.
- C. Insulate pipes in accordance with the insulation schedule.
- D. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections and expansion joints.
- E. On insulated piping without vapor barrier for pipes conveying fluids 180° F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.
- F. Install materials in accordance with the manufacturer's instructions.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- H. Insulation on all cold water systems shall be applied with a continuous unbroken vapor seal.
- I. Do not allow hangers, supports, anchors etc., to come in direct contact with the pipe.
- J. Insulate entire system including fittings, unions and flexible connections, flanges and expansion joints. For insulation of valves and other pieces of equipment, see Section 22 07 00. At fire separations, Refer to Section 22 05 17 and Division 7 - Fire Stopping.
- K. Insulation shall not be applied until system is tested, cleaned and approved.
- L. Heat Traced Piping: Ensure that any required heat trace is installed prior to insulation. Heat trace is not provided under Mechanical. Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.

3.3 GLASS FIBER INSULATION (PIPING)

- A. Cover pipe with glass fiber insulation in thickness scheduled.

- B. When vapor barrier is required, adhere factory applied vapor barrier jacket lap smoothly and securely at longitudinal laps with pressure sensitive strip. Adhere self-sealing butt joint strips over end joints. No staples will be allowed.
- C. Insulate fittings and joints with molded insulation of like material and thickness of adjacent pipe with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
- D. Cover insulation with one piece PVC fitting covers.

3.4 JACKETS AND FITTING COVERS (PIPING)

- A. Apply insulation prior to installation of jackets and fitting covers.
- B. Pipe exposed in tunnels and insulated pipe located outdoors and insulated pipe penetrations through exterior walls: finish with aluminum jacket and fitting covers.
- C. Pipe exposed in finished spaces less than 10 feet above finished floor, and where indicated on drawings: finish with PVC jacket and fitting covers.
- D. Secure PVC jackets and fitting covers with stainless steel tacks and wrap seams and tacks with vinyl tape.
- E. Install aluminum jackets located outdoors with seams located on bottom side of horizontal piping. Apply sealing compound and closures to make weathertight.

3.5 INSERTS AND SHIELDS

- A. Inserts: Heavy density insulation which will not crush from weight of pipe. Locate between shield and pipe. Inserts are furnished in this Section 22 07 00 and installed in Section 22 05 29.
- B. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and insulation. Shields are furnished and installed under Section 22 05 29.

PART 4 - SCHEDULES

4.1 SCHEDULES

- A. Insulate equipment including valves, tanks, air removal devices, etc.
- B. Valves, traps, etc.: Extend insulation 6 inches beyond flanges.

4.2 SCHEDULES - PIPING

Insulation Schedule - Piping					
System	Operating Temperature (degrees F)	Insulation Type	Pipe Size (inches)	Insulation Thickness (inches)	Notes
Domestic Cold Water (above ground)	—	glass fiber	less than 1"	½	1
			1" and greater	1	
Notes:					

END OF SECTION

SECTION 221000
PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Equipment Drain Piping, Buried
- B. Equipment Drain Piping, Above Grade
- C. Domestic Water Piping, Above Grade
- D. Domestic Water Piping, Buried
- E. Indirect Waste and Cooling Coil Condensate Piping

1.2 RELATED SECTIONS

- A. Section 22 05 00 – Common Work Results for Plumbing
- B. Section 22 05 29 – Hanger and Supports for Plumbing Piping and Equipment
- C. Section 22 05 48 – Vibration Controls for Plumbing Piping and Equipment
- D. Section 22 05 49 – Seismic Controls for Plumbing Piping and Equipment
- E. Section 22 05 53 – Identification for Plumbing Piping and Equipment
- F. Section 22 07 00 – Plumbing Insulation
- G. Section 23 25 00 – HVAC Water Treatment

1.3 REFERENCES

- A. General
 - 1. ASME B31.1 - Power Piping
 - 2. ASME B31.9 - Building Service Piping
 - 3. ASME SEC IX - Welding and Brazing Qualifications
 - 4. ASTM E814 - Fire Tests of Through-Penetration Fire Stops
 - 5. ASTM F708 - Design and Installation of Rigid Pipe Hangers
 - 6. AWWA C651 - Disinfecting Water Mains
 - 7. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer
 - 8. MSS SP69 - Pipe Hangers and Supports - Selection and Application
 - 9. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices
 - 10. NCPWB - Procedure Specifications for Pipe Welding
 - 11. UL 1479 - Fire Tests of Through-Penetration Firestops
- B. ABS Piping
 - 1. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings
 - 2. ASTM D2661 - Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
 - 3. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
 - 4. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- C. Cast Iron Pipe and Fittings
 - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
 - 2. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250
 - 3. ASTM A74 - Cast Iron Soil Pipe and Fittings
 - 4. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - 5. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems

6. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems
- D. Copper Piping
 1. ASME B16.22 - Wrought Copper and Bronze Solder Joint Pressure Fittings
 2. ASTM B32 - Solder Metal; AWS A5.8 - Brazing Filler Metal
 3. ASTM B75 (ASTM B75M) - Seamless Copper Tube
 4. ASTM B88 (ASTM B88M) - Seamless Copper Water Tube
 5. AWS A5.8 - Brazing Filler Metal
- E. Ductile Iron Piping
 1. ASME B16.3 – Malleable Iron Threaded Fittings
 2. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
 3. AWWA C110 - Ductile - Iron and Gray - Iron Fittings 3 inches through 48 inches, for Water and Other Liquids
 4. AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings
 5. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
- F. PVC Piping
 1. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 2. ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
 3. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 4. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
 5. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 6. ASTM F437 - Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
 7. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 8. ASTM F679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
 9. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches Through 12 inches for Water Distribution
- G. Steel Piping
 1. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
 2. ASTM A234/A234M - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

1.4 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Section 22 05 00.
- B. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturers catalog information. Indicate ratings.

1.5 QUALITY ASSURANCE

- A. Welding Materials and Procedures: Conform to ASME SEC IX and applicable state regulations.
- B. Welders Certification: In accordance with ASME SEC IX.
- C. Installer Qualifications: Installer shall have successfully completed the Uponor Commercial Piping Systems Training Course (formerly Uponor AquaPEX Certification) and is able to provide proof/verification. Course shall be conducted by the manufacturer or a manufacturer's representative.

1.6 REGULATORY REQUIREMENTS

- A. Coordinate and comply with serving utility company requirements.

- B. Installation and materials of underground pipe, including service piping, if required, shall be as directed by serving utility company.
- C. Include applicable utility company charges - See Section 22 05 00.
- D. All piping, fittings, valves, fixtures, faucets and equipment containing or conveying potable water shall comply with the latest US Safe Drinking Water Act mandating any wetted surface of the above mentioned items shall not contain above 0.25% lead content by weighted average. All piping, fittings, valve and equipment containing or conveying potable water shall comply with NSF 61 G and NSF 372 or shall be provided with indication on submittals the manufacturer's declaration of self-certification.

1.7 TESTING

- A. Water Piping
 - 1. Upon completion of a section or of the entire hot and cold water supply system, it shall be tested and proved tight under a water pressure not less than the working pressure under which it is to be used or 100 psig whichever is greater. The water used for tests shall be obtained from a potable source of supply. A fifty (50) pound per square inch air pressure may be substituted for the water test. In either method of test, the piping shall withstand the test without leaking for a period of not less than thirty (30) minutes. Tests shall be made in the presence of the Owner's Representative. Test water piping to connection point at main outside the building.
- B. Records
 - 1. Provide record of pipe tests in accordance with Section 22 05 00.
 - 2. Include certificate of Tests in O&M Manual.
 - 3. Include certificate of Health Department approval of domestic water quality in O&M Manual.

1.8 DELIVERY, STORAGE, AND HANDLING (REFER TO SECTION 22 05 00)

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.9 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: PEX-a manufacturer system warranty shall cover piping and fittings for a duration of 25 years from the date of installation. Piping system warranty shall apply to potable water distribution and water service systems constructed of pipe and fitting products sourced from the same manufacturer.

1.10 DRAWING SCHEDULES

- A. Refer to schedules on drawings for model numbers, symbols, etc. for additional information concerning products specified in this section.

PART 2 - PRODUCTS

2.1 EQUIPMENT DRAIN PIPING, BURIED

- A. Cast Iron Pipe: ASTM A74 service weight
 - 1. Fittings: Cast iron
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets

- B. Cast Iron Pipe: CISPI 301, hubless, service weight
 - 1. Fittings: Cast iron
 - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies
- C. No-hub couplings
 - 1. Approved Manufacturers (refer to Section 22 05 00)
 - a. Husky SD 2000
 - b. Clam-All Hi Torque 80
 - c. Fernco
 - 2. Materials: The worm gear drive clamps shall have a hexagon head to accept a 5/16 inch socketed torque wrench. The gaskets shall be manufactured using neoprene rubber meeting the requirements of ASTM C-564. Sealing rings shall be molded into the gasket and positioned under each torquing band. Couplings shall meet the performance requirements of coupling standard FM 1680 class 1.
 - 3. Corrugated Couplings
 - a. Shield constructed of 304 corrugated stainless steel with a minimum thickness of 0.010".
 - b. Coupling pipe sizes 1 1/4" through 4" shall have 4 bands.
 - c. Couplings for pipe sizes 5" through 10" shall have 6 bands.
- D. Schedule 40 DWV ABS Pipe: ASTM D2661 or ASTM D2751
 - 1. Fittings: ABS
 - 2. Joints: ASTM D2235, solvent weld
 - 3. Hollow core and cellular core pipe and fittings are not allowed.
- E. Schedule 40 DWV PVC Pipe: ASTM D2665 or ASTM D3034
 - 1. Fittings: PVC
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement
 - 3. Hollow core and cellular core pipe and fittings are not allowed.

2.2 EQUIPMENT DRAIN PIPING, ABOVE GRADE

- A. Type M copper tubing with soldered Joints.
- B. Cast Iron Pipe: ASTM A74, service weight
 - 1. Fittings: Cast iron
 - 2. Joints: ASTM C564, neoprene gasket system or lead and oakum
- C. Cast Iron Pipe: CISPI 301, hubless, service weight
 - 1. Fittings: Cast iron
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies
- D. Steel Pipe: ASTM A53 Schedule 40, galvanized
 - 1. Cast Iron Fittings: ASME B16.4, threaded fittings
 - 2. Malleable Iron Fittings: ANSI/ASME B16.3, screwed type
- E. No-hub couplings
 - 1. Approved Manufacturers (refer to Section 22 05 00):
 - a. Husky SD 2000
 - b. Clam-All Hi Torque 80
 - c. Fernco
 - 2. Materials: The worm gear drive clamps shall have a hexagon head to accept a 5/16 inch socketed torque wrench. The gaskets shall be manufactured using neoprene rubber meeting the requirements of ASTM C-564. Sealing rings shall be molded into the gasket and positioned under each torquing band. Couplings shall meet the performance requirements of coupling standard FM 1680 class 1.
 - 3. Corrugated Couplings
 - a. Shield constructed of 304 corrugated stainless steel with a minimum thickness of 0.010".
 - b. Coupling pipe sizes 1 1/4" through 4" shall have 4 bands.
 - c. Couplings for pipe sizes 5" through 10" shall have 6 bands.

2.3 WATER PIPING, BURIED

- A. Copper Tubing: ASTM B42, hard drawn, Type K
 - 1. Fittings: ASME B16.22 wrought copper and bronze
 - 2. Joints: AWS A5.8, BCuP silver braze
 - a. Exception: Trap primer piping below slab may be continuous lengths of soft copper or pex a piping provided piping has not joints under the slab.
 - 3. Wrap for Underground Piping: Calpico Inc. pipe wrapping polyvinyl tape, 20 mil thickness, with identification per IAPMO.
- B. Copper Tubing: ASTM B42, annealed, Type K
 - 1. Fittings: none
 - 2. Joints: none
- C. Ductile Iron Pipe: AWWA C151
 - 1. Fittings: AWWA C110, Ductile iron, standard thickness
 - 2. Joints: AWWA C111, rubber gasket with $\frac{3}{4}$ inch diameter rods

2.4 WATER PIPING, ABOVE GRADE (COPPER)

- A. This includes domestic/potable, non-potable and make-up water.
- B. Steel Pipe: ASTM A53 Schedule 40, galvanized
 - 1. Cast Iron Fittings: ASME B16.4, threaded fittings
 - 2. Malleable Iron Fittings: ANSI/ASME B16.3, screwed type
- C. Copper Tubing: ASTM B88, Type L, hard drawn
 - 1. Fittings: ASME B16.22, wrought copper and bronze
 - 2. Joints: ASTM B32, solder, Grade 95TA

2.5 INDIRECT WASTE AND COOLING COIL CONDENSATE DRAIN PIPING:

- A. Type M copper tubing with soldered Joints. Min. size $\frac{3}{4}$ "

2.6 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2 inches and under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions
 - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints
- B. Pipe Size over 2 inches:
 - 1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets
 - 2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets

2.7 DIELECTRIC PIPE FITTINGS:

- A. Dielectric Unions: Factory-fabricated, union assembly for 250 psig minimum working pressure at a 180°F temperature.
 - 1. Manufacturers: Epco Sales, Inc.; Watts Industries, Inc. – Water Products Division or Zurn Industries, Inc. – Wilkins Division.
- B. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150- or 300-psig minimum pressure to suit system pressures.
 - 1. Manufacturers: Epco Sales, Inc. or Watts Industries, Inc. – Water Product Division.
- C. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or Phenolic gasket, Phenolic or polyethylene bolt sleeves, Phenolic washers, and steel backing washers.
 - 1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.

2. Manufacturers: Advance Products & Systems, Inc.; Calipco, Inc. or Pipeline Seal and Insulator, Inc.
- D. Dielectric Couplings: Galvanized-Steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225°F temperature.
 1. Manufacturers: Calpico, Inc. or Lochinvar Corp.
- E. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 225°F temperature. Nipples shall be listed by IAPMO/UPC and SBCCI PST and ESI.
 1. Manufacturers: Precision Plumbing Products, Inc.; Sioux Chief Manufacturing Co., Inc.; Perfection Corp. or Victaulic Co. of America.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION – GENERAL

- A. Provide pipe in accordance with manufacturer's instructions and as indicated on the drawings.
- B. Install valves in piping system in accordance with 22 05 03 and as indicated on plans.
- C. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Wet Piping Systems (water): Install dielectric coupling and nipple fgt.
- D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls. Install piping without sags or bonds.
- E. Allow for sufficient space above removable ceiling panels to allow for ceiling panel removal.
- F. Provide piping and all required offsets and fittings in order to coordinate with other trades, minimize structural interferences, conserve space and maintain headroom. Refer to Section 22 05 00 Common Work Results for Plumbing Piping.
- G. Group piping whenever practical at common elevations.
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare exposed, ferrous metals (unfinished pipe, fittings, supports, and accessories) ready for finish painting. Refer to Division 9.
- M. Excavate and backfill in accordance with Section 22 05 00.
- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Provide supports, hangers, insulation shields, sleeves, escutcheons, and inserts in accordance with Section 22 05 29 and 22 05 17.
- Q. Provide flexible pipe connections at exterior building wall.

- R. Provide pipe wrap for all copper pipe installed below ground.
- S. Pipe Insulation thru Concrete.
 - 1. General: Provide a minimum 1-inch thick pipe insulation for all copper pipe installed through concrete, footings, grade beams, etc.
 - 2. Cleaning: Remove loose scale, rust, dirt, oil and grease before wrapping.
 - 3. IMOC, IMCOSHIELD, non-slit pre-lubricated polymer foam insulation. H.
- T. Provide proper firestop protection of PVC or ABS piping penetrations of fire-resistant-rated walls, shafts, or floor-ceiling assemblies.
- U. Hubless Piping: Clamps shall be tightened to 80 inch pound and installed in accordance with the manufacturers requirements.
- V. Connect branch piping to top of mains.
- W. Combination double wye and 1/8th bend fittings are only allowed for vertical drainage. For horizontal drainage, double wye DWV fittings are allowed if separate 1/8th bend fittings are used for the branches.

3.3 APPLICATION

- A. Flanges / Unions:
 - 1. Steel Pipe:
 - a. Threaded pipe, 2 inches smaller: Install unions downstream of each valve with screwed joint upstream
 - b. Welded pipe, 2 ½ inches and larger: Flanged connections both sides of valve
 - c. Use unions at final connection to each piece of equipment or apparatus having a threaded pipe connection.
 - d. Use flanges at final connection to each piece of equipment or apparatus having a flanged pipe connection.
 - 2. Copper Pipe:
 - a. Threaded pipe: Install union down stream of each valve with screwed joint up stream. Use brass male adapters each side of valve.
 - b. Soldered pipe: No unions required either side of valve.
 - c. Use unions at final connection to each piece of equipment or apparatus having a threaded pipe connection.
 - d. Use flanges at final connection to each piece of equipment or apparatus having a flanged pipe connection.
 - 3. Notes to above: Temperature control valves shall have unions and/or flanges at each port. Valves with screwed connections that cannot be rotated shall have unions on each side of valve. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- B. Provide brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.4 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to ¼ inch/foot, 2 %, minimum unless indicated otherwise on drawings. Maintain gradients.
- B. Install piping so that entire system is drainable. Provide drain valves with hose connections at low points.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 % of outlets.
- E. Maintain disinfectant in system for twenty-four (24) hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than twenty-four (24) hours after flushing, from 10 % of outlets and from water entry, and analyze in accordance with AWWA C651. Provide laboratory results to Owner's Representative. Obtain approval from local health department.

END OF SECTION

DIVISION 23

SECTION 230500
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

- A. Refer to Divisions 00 & 01 of these specifications, which govern work under Division 23. Refer to other sections of these specifications for additional related requirements.

1.2 SCOPE OF REQUIREMENTS

- A. The work covered by Division 23 of the specifications (HVAC/Mechanical) shall include but not limited to furnishing all materials and supplying all labor, equipment, and services to install the complete mechanical systems as shown on the accompanying drawings and specified herein.
- B. Work done under Division 23 of the specifications shall comply with the requirements specified herein.

1.3 ALTERNATES (REFER TO DIVISION 00)

- A. The bid price for each alternate shall include a complete working Division 23 system as described in the alternates, shown on the drawings, and indicated in these specifications.

1.4 CODES, PERMITS AND FEES

- A. Division 23 work shall be in accordance with the following as adopted by the governing agencies, including amendments:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Applicable State and Local Codes and Ordinances
 - 3. National Electrical Code
 - 4. International Building Code
 - 5. International Fire Code
 - 6. International Mechanical Code
 - 7. Uniform Plumbing Code
 - 8. Washington State Non-Residential Energy Code
 - 9. Washington State Boiler and Unfired Pressure Vessel Code
 - 10. International Fuel Gas Code
- B. Permits and inspections required for the Division 23 work on this project shall be obtained as part of the Division 23 scope of work, and the cost for these permits and inspections shall be included in the Division 23 bid. All inspection certificates shall be delivered to the Owner's Representative prior to final acceptance of the work in accordance with the requirements of these specifications.
- C. All costs levied by utility companies and/or governing agencies shall be included in the Division 23 scope of work and shall be included in the Division 23 bid.
- D. Work shall comply with all regulations associated with all applicable utilities.

1.5 INTENT AND INTERPRETATIONS

- A. It is the intent of these plans and specifications to result in a complete and working Division 23 installation in complete accordance with all applicable codes and ordinances.
- B. The drawings and these specifications are intended to supplement each other. Any details contained in either the drawings or these specifications shall be included as if contained in both.
- C. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

1.6 DEFINITIONS

- A. The term "Acceptance", when used in Division 23, shall be defined as the Owner's assumption of ownership for part or all of the Division 23 system. Acceptance of part or all of the Division 23 system, when granted prior to completion of Division 23 work and/or correction of deficiencies, shall not relieve Division 23 of any responsibility for completion of this work and/or correction of these deficiencies.
- B. The term "Date of Acceptance", when used in Division 23, shall be the official date when Acceptance, as defined in these specifications, occurs. The Date of Acceptance shall be assumed to coincide with granting of Substantial Completion unless noted otherwise by the Owner's Representative. Deviation of the Date of Acceptance from Substantial Completion can assume to have occurred only when written documentation is provided by the Owner's Representative specifically indicating this separation and identifying an alternative designation for the Date of Acceptance.
- C. The terms "The Contractor" or "This Contractor", when used, shall be defined as the Contractor responsible for Division 23 work.
- D. The term "Owner's Representative", when used, shall refer to the Architect or his designated representative in accordance with Division 00 and 01.
- E. The term "Provide" shall mean furnish and install.
- F. The term "HVAC" or "Mechanical", when used, to distinguish a particular scope of work or portion of the documents, shall mean the Division 23 scope of work and Division 23 documents (drawings and specifications) respectively.

1.7 DRAWINGS

- A. HVAC and Mechanical drawings show general arrangement of piping, ductwork, equipment, etc. Drawings shall be followed as closely as actual building construction and work of other trades will permit.
- B. Architectural and Structural drawings and specifications shall be considered part of this work insofar as they furnish information relating to design and construction of the building. These documents take precedence over Division 23 drawings and specifications if any dimensional discrepancies exist.
- C. Drawings are diagrammatic only. Consequently, all required duct and pipe offsets are not indicated on the drawings. Offsets as required to meet the design intent of the drawings shall be provided.

1.8 GUARANTEE (REFER TO DIVISIONS 00 AND 01)

- A. The Division 23 equipment, materials, and installation shall be guaranteed for a period of one (1) year unless an individual item or specification is otherwise noted as longer. All defects in Division 23 work and/or equipment furnished that develop at any time during the one year guarantee period shall be corrected at no cost to the owner, including any expenses for cutting, patching, and repairing made necessary by corrections of unsatisfactory work and/or damage resulting from incorrect equipment operation.
- B. The guarantee period shall begin upon the Date of Acceptance. When Acceptance is granted for portions of the Division 23 system at different times, the guarantee for each portion of the Division 23 system shall begin upon Acceptance of that portion of the Division 23 system.
- C. Permission to use the permanent Mechanical system for temporary heating during construction does not constitute acceptance. All product and system warranties shall be extended at no cost to the Owner as required to maintain this one (1) year requirement from the Date of Acceptance if such permission is given.
 - 1. Exception: Use of part or all of the Division 23 system prior to the Date of Acceptance, when initiated by the Owner, shall constitute Acceptance of the specific piece of equipment and/or

portion of the system only when acknowledgement of Acceptance is noted in written authorization from the Owner as required in these specifications.

- D. Equipment warranties in addition to this guarantee shall be provided in accordance with the table at the end of this section.

1.9 FILTERS

- A. Refer to paragraph "Use of Equipment During Construction" Section 23 05 00.
- B. New filters shall be installed prior to system startup.
- C. If systems are operated prior to testing, adjusting, and balancing (TAB), new filters shall be installed prior to starting (TAB) work.
- D. Filters in portions of Division 23 systems that are completed and used prior to overall project substantial completion shall be changed as required to protect the Division 23 systems.
- E. New filters shall be provided at time of overall project substantial completion. In addition, an extra set shall be furnished as additional stock.

1.10 COST BREAKDOWN

- A. Refer to Divisions 00 and 01 for supplemental requirements.
- B. A breakdown of the HVAC construction cost shall be furnished to the Owner's Representative within 30 days of Notice to Proceed, with separate costs for each of the items listed in the cost breakdown in Part 4 of this section.

1.11 PAYMENT REQUESTS

- A. Refer to Divisions 00 and 01 for supplemental requirements.
- B. Payment requests for materials and equipment will not be reviewed or approved until submittals and operation and maintenance data have been received and approved.
- C. Payment requests for the Energy Management and Control System (EMCS) will not be reviewed or approved until submittals required under Section 23 09 23 have been received. Once these submittals have been received, only payment requests for programming and submittals will be reviewed until all submittals required under Section 23 09 23 have been reviewed and approved. Payment requests for materials and/or installation will not be reviewed prior to approval of all submittals required under Section 23 09 23.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS – STANDARDS AND CODES

- A. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated "new" equipment is not acceptable. Each item of equipment and material shall conform to the latest Standard Specifications of the American Society for Testing Materials and shall conform to any applicable standards of the United States Department of Commerce.
- B. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to the Owner.
- C. Motor efficiencies shall meet or exceed the requirements of the applicable energy code.
- D. All electrically driven or connected equipment shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC.
- E. Equipment shall be UL listed as an assembly where listing/labeling program is available for that type of equipment.

- F. All control panels shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC and applicable local electrical codes.
- G. Fuel fired equipment shall be listed by a nationally recognized testing laboratory for use with the particular fuel type.
- H. All pressure vessels and relief valves shall be furnished in accordance with applicable State Boiler and Unfired Pressure Vessel Laws. This shall include rating and stamped in accordance with the ASME Boiler and Pressure Vessel Code where required by Code authorities or State Law.

2.2 EQUIPMENT/MATERIAL SUBSTITUTIONS

- A. Throughout these specifications and drawings, various materials, equipment, apparatus, etc., are specified or scheduled by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of design and the bid.
- B. Substitutions will not be permitted without written approval. (Refer to Divisions 00 and 01.)
- C. Where two or more manufacturer designations are listed in these specifications, choice will be optional with the Contractor except that where more than one manufacturer is listed and only one manufacturer's catalog number is specified or only one manufacturer scheduled on the drawings (basis of design), that standard of quality, dimensional characteristics, capacities, and construction shall be maintained by materials or equipment supplied by the other manufacturer(s).
- D. Substituted equipment with efficiencies less than 95 % of the basis of design efficiency shall not be considered equal to the basis of design.
- E. If the Division 23 Contractor uses manufacturers other than the basis of design, the Contractor shall be responsible for:
 - 1. Insuring the substituted item will fit the available space while allowing proper maintenance access
 - 2. Any changes required by other Contractors caused by the substituted equipment
 - 3. Changes in electrical requirements: See "Equipment Substitutions – Electrical Characteristics" below
 - 4. Changes in structural design due to weight differences
- F. In the event other than specified equipment is used and will not fit job site conditions, this Contractor shall assume responsibility for replacement with items indicated as the basis of design.

2.3 EQUIPMENT SUBSTITUTIONS – ELECTRICAL CHARACTERISTICS

- A. Products furnished other than the basis of design shall have similar electrical characteristics as the scheduled or specified equipment. The Contractor shall be responsible for any electrical changes caused by products not in accordance with this requirement.

2.4 SUBMITTALS FOR REVIEW

- A. Refer to Divisions 00 and 01 for supplemental requirements.
- B. Shop drawings, catalog information and material schedules shall be submitted for approval on all specified materials and equipment in Division 23 prior to ordering.
- C. Provide specific wiring diagrams for all equipment requiring electrical or control wiring. Upon approval, copies of these diagrams shall be forwarded to pertinent contractors.
- D. Furnish complete shop drawing/catalog data for equipment and materials to be used in the work for review. Allow sufficient time for developing shop drawings, processing and review time so that the installation will not be delayed.
- E. Shop drawings shall be reviewed, approved and stamped by the Contractor prior to submitting to Owner's Representative for approval. Submittals without such approval will be returned without review.

- F. Where choices of options and accessories are available or specified, provide written description of what is to be furnished. If necessary, list page numbers where submitted items are described.
- G. State sizes, capacities, brand names, motor horsepower, electrical characteristics, accessories, materials, gauges, dimensions, and other pertinent information.
- H. Underline applicable data.
- I. If material or equipment is not as specified or submittal is not complete, it will be rejected. Only complete submittal including all applicable specification sections will be reviewed.
- J. Field applied adhesives, sealants, fillers, primers, glues, and paint shall have VOC's that are equal to or lower than the requirements as identified in part 3 of this section.
- K. Provide cut sheets and a Material Safety Data Sheet (MSDS) for each field applied sealant, adhesive, coating, paint etc used in the building, highlighting VOC limits and chemical component limits. Also indicated in addition to actual VOC emissions identify allowed limits of each product to demonstrate compliance. Submit all proposed field applied products as a single submittal for review with their MSDS data.
- L. Catalog data or shop drawings for equipment which are noted as being reviewed shall not supersede Contract Documents.
- M. Review comments shall not relieve the Contractor from responsibility for deviations from Contract Documents unless attention has been called to such deviations in writing at time of submission, nor shall they relieve this Contractor from responsibility for errors in items submitted.
- N. Check work described by catalog data with Contract Documents for deviations and errors.
- O. Shop drawings and submittal information shall be provided for all required Division 23 equipment in a single submittal.
 - 1. Exceptions: At the discretion of the Owner's Representative, partial project submittals may be allowed.
- P. Submittal Format:
 - 1. Electronic submittals shall be provided with accordance with all of the following conditions. Electronic submittals which do not comply with all of these conditions will be rejected without review.
 - a. Electronic submittals shall be submitted in the current version of Adobe Portable Document Format (PDF)
 - b. Submittals shall be original PDF's of the document and shall not be created using scanned copies of paper documents.
 - c. PDF documents shall be searchable.
 - d. PDF documents shall be unlocked
 - e. Electronic submittals shall be separated by specification section and identified as such. Submittals which combine multiple sections into a single document will be rejected.
 - f. Electronic submittals shall include a table of contents and each applicable section shall be bookmarked for easy access.
 - g. Electronic submittals shall be clearly marked in RED using boxes and arrows and other appropriate markings to indicate specific product information, option selections, accessories, etc.
- Q. Each product shall be keyed to the paragraph number in the specifications.
- R. Operation and maintenance data for individual equipment shall also be provided subsequent to approval of equipment submittals in a separate binder meeting the same requirements as the submittal binder. Refer to Part 3 of this specification for supplemental requirements.
- S. All submittals and re-submittals as required shall be provided with a cover page incorporating a table similar to that provided at the end of this section. The appropriate box(es) shall be checked on each line item for all submittals.

PART 3 - EXECUTION

3.1 LOCATIONS

- A. Coordination of Division 23 equipment and systems to the available space, with other trades and to the access routes through the construction shall be the Contractor's responsibility.
- B. Drawings are diagrammatic. Make offsets, transitions, and changes in direction of pipes and ducts as required to maintain proper head room and pitch of sloping lines and avoid structural, electrical, pipe and duct interferences whether or not indicated on Drawings. Furnish fittings, etc., as required to make these offsets, transitions and changes in direction at no additional cost to the Owner.
- C. Pipe and duct routing shall be coordinated and verified with all trades prior to fabrication and installation. Additional project costs resulting from failure to do so shall be the Contractor's responsibility.
- D. Determine exact route and location of each pipe and duct and coordinate and obtain approval for changes from the layout indicated on the drawings with the Owner's Representative prior to fabrication.
- E. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Verify the physical dimensions of each item of Division 23 equipment to fit the available space and promptly notify the Owner's Representative prior to roughing-in if conflicts appear.
- F. All piping, wiring, equipment, ductwork, tubing, etc., shall be concealed within building construction unless otherwise noted, or in Division 23 rooms.
- G. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, trap primers, starters, motors, control components, and to clear openings of doors and access panels.
- H. Existing Utilities and Piping
 - 1. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a 10 foot radius of the indicated location. Where connection points are not within this radius, the Contractor shall contact the Owner's Representative for a decision before proceeding or may proceed at his own expense.
 - 2. Connection points to existing work shall be located and verified prior to starting new work.
 - 3. Prior to commencing any excavation or ditching activity, the Contractor shall verify the exact location and inverts of all existing utilities and connection points in the area of his proposed excavation. Notify the Owner's Representative for further direction if actual inverts will not allow the proper installation of new work.
 - 4. The Contractor shall be responsible for damages which might be caused by his failure to exactly locate and preserve underground utilities.

3.2 SCHEDULING

- A. It is understood that while drawings are to be followed as closely as circumstances permit, the Contractor shall be responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Owner's Representative. Should conditions arise where certain changes would be advisable, secure approval from Owner's Representative for those changes before proceeding with work.
- B. The contractor shall coordinate with the work of various trades when installing interrelated work. Before installation of Division 23 items, proper provisions shall be made to avoid interferences. Changes required in work specified in Division 23 caused by neglect to do so shall be made at no cost to Owner.
- C. Supports and inserts in concrete required for Division 23 supports shall be furnished and installed unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to those involved in sufficient time to be built into construction as the

Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne under Division 23.

3.3 CUTTING AND PATCHING

- A. All cutting and patching of new and existing construction required for the installation of systems and equipment specified in Division 23 shall be the responsibility of the Division 23 Contractor. All cutting shall be accomplished with masonry saws, drills or similar equipment to provide neat uniform openings.
- B. Walls, floors, ceilings and roof shall be patched and repaired with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials. All patching shall meet the approval of the Owner's Representative.
- C. All cutting and patching made necessary to repair defective equipment, defective workmanship or be neglect of this Contractor to properly anticipate his requirements shall be included in Division 23.
- D. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses or other structural members without the Owner Representative's written approval.
- E. Cutting, patching, repairing, and replacing pavement, sidewalks, roads, and curbs to permit installation of work specified or indicated under Division 23 is responsibility of Division 23.

3.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Refer to Divisions 00 and 01 for supplemental requirements.
- B. Follow manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.
- C. Promptly notify Owner's Representative in writing of conflicts between requirements of Contract Documents and Manufacturer's directions and obtain written instructions from Owner's Representative before proceeding with work. The Contractor shall bear expenses arising from correcting deficiencies of work that do not comply with manufacturer's directions or such written instructions from Owner's Representative.
- D. Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in a dry, heated space.
- E. Notify Owner of equipment delivery dates twenty-four (24) hours in advance of delivery.
- F. The Contractor shall be responsible for protection of equipment furnished in Division 23 from vandalism and weather during all phases of construction. Damaged equipment shall be restored to like new condition or replaced at the Contractor's expense.
- G. Ductwork shall be stored on pallets off of grade. Internally lined ductwork and air handling equipment shall be kept dry. Internal insulation that has been allowed to become wet will be rejected. Air handling equipment that has been allowed to become wet may be rejected.
- H. Any factory painted equipment scratched or marred during shipment or construction shall be restored to original "new" condition. This includes complete repainting if necessary to provide exact paint match.

3.5 VISITING THE PROJECT SITE

- A. The premises shall be examined and conditions shall be understood which may affect performance of work of Division 23 before submitting proposals for this work.
- B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions.

3.6 TESTS

- A. See individual specification sections for Testing Requirements.

3.7 EXCAVATION AND BACKFILL

- A. Comply with Division 31 and the requirements of this section.
- B. Provide all necessary excavation, shoring, bedding and backfilling required for the installation of work specified and indicated under Division 23. This shall include but not be limited to ductwork and piping and other miscellaneous items inside building premises or outside as may be necessary.
- C. Compaction testing shall conform to ASTM D-1557 for cohesive soils and ASTM D-2049 for cohesionless soils.
- D. Requirements of Regulatory Agencies
 - 1. Proper approval shall be obtained in accordance with applicable City, County and/or State regulations.
 - 2. All safety regulations must be observed including applicable OSHA regulations.
- E. Existing Conditions
 - 1. A geotechnical investigation report may be available and included in the project manual for information only.
 - 2. Data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner or his representative will not be responsible for interpretations or conclusions drawn from this information.
- F. Protection
 - 1. Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations. Provide temporary utility services where necessary to maintain continuity of service. Provide minimum of seventy-two (72) hour notice to Owner prior to all utility interruptions. Remove existing utilities indicated to be removed. Where uncharted or incorrectly charted utilities are found, contact utility owner immediately for instructions.
 - 2. Protect structures, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations. Damage resulting from excavation operations shall be repaired by the Contractor at his expense.
 - 3. Slope sides of excavation to comply with State and local codes and ordinances. Shore and brace as required for stability of excavation. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Remove shoring and bracing when no longer required.
 - 4. Install sediment and erosion control measures in accordance with State and local codes and ordinances. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 °F.
 - 5. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
 - 6. Stockpile satisfactory excavated materials until required for backfill (place, grade, and shape stockpiles for proper drainage). Locate and retain soil materials away from edge of excavations. Remove and legally dispose of excess excavated materials and materials not suitable for use as backfill. Prevent spillage during hauling operations. In case of spills, clean streets, walks, etc. with power sweepers or as directed by the Owner's Representative.

- G. Excavate to uniform width, sufficiently wide to provide ample working room clearance on all sides of pipe, duct, tanks, and equipment. Excavate trenches to depth indicated or required for piping to establish indicated slopes and invert elevations. Where rock is encountered, carry excavation below required elevation and backfill with a minimum 6 inch layer of bedding material between rock bearing surface and pipe. At each pipe joint over-excavate to relieve the bell or pipe joint of pipe loads, and to ensure continuous bearing of pipe barrel on the bearing surface.
- H. Minimum trench width shall be the width of the pipe plus 16 inches or the pipe outside diameter times 1.25 plus 12 inches to allow adequate room for joining the pipe, snaking the pipe in the trench to allow for expansion and contraction where appropriate and space for backfilling and compaction of backfill. The space between the pipe and the trench wall shall be wider than the compaction equipment used to compact the backfill.
- I. All pipe shall be laid on 6 inch minimum depth of bedding material.
- J. Bedding material shall consist of sand, sandy gravel or fine crushed gravel having a maximum size of $\frac{3}{4}$ inch. Place bedding material under and around the pipe to 6 inches above the top of the pipe. Distribute material in maximum layers of 6 inches and thoroughly compact by tamping. Take care to assure compaction under the haunches of the pipe. Note: pea gravel should not be used for pipe bedding.
- K. Where pipes pass under column or wall footings, or within the volume included by extending down from the edge of column or wall footings at a 45 degree angle, and top of pipe is within 2 feet 6 inches below the bottom of the footing, pipes shall be encased in either a steel sleeve or 6 inches of lean (1,500 psi, 28 day test) concrete all around the pipe, extending 5 feet beyond each side of the footing. Where the top of pipe is within 1 foot of the bottom of the footing, concrete encasement, if used, shall extend up to the bottom of the footing.
- L. Backfill excavations as promptly as work permits, but not until completion of inspection, testing and approval by authorities having jurisdiction, recording of locations of underground utilities, removal of concrete formwork, removal of shoring and bracing and backfilling of voids, and removal of trash and debris.
- M. Backfill material shall be free of cinders, ashes refuse, organic and frozen material, boulders or other unsuitable materials. Suitable material excavated from the trench or other suitable site material not containing rocks in excess of 6 inches in their maximum dimension shall be used for backfill in quantities available. Provide additional suitable material as needed to complete backfilling operations.
- N. Place backfill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Where layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- O. Do not place backfill material on surfaces that are muddy, frozen, or contain frost or ice. Place backfill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift. Compact carefully against foundation, basement and retaining walls so as not to create excessive pressure on walls.
- P. Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below. Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D-1557, and not less than the following percentages of relative density, determined in accordance with ASTM D-2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

1. Areas under Structures, Building Slabs, Steps, Pavement and Walkways: Compact each layer of backfill material to 90 % maximum density of cohesive material, or 95 % relative density for cohesionless material.
2. Other Areas: Compact each layer of backfill material to 85 % maximum density for cohesive soils, and 90 % relative density for cohesionless soils.
3. Where subsidence occurs at Division 23 installation excavations during the warranty period, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

- Q. Bedding, backfill, and excavation for thermoplastic pipe (including PVC) shall additionally comply with the manufacturer's recommendations and with ASTM D2774 (Standard Practice for Underground Installation of Thermoplastic and Pressure Piping) and ASTM F1668 (Standard Guide for Construction Procedures for Buried Plastic Pipe).

3.8 COMMISSIONING SUPPORT

- A. The equipment and systems referenced in the Related Work section are to be commissioned per Division 1 and Division 23 commissioning specifications. The contractor has specific responsibilities for scheduling, coordination, startup, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.
- B. Include allowance in the bid to support commissioning. Allowance shall be a separate line item on the schedule of values.
- C. Include time for commissioning activities on the construction schedule to complete commissioning prior to substantial completion with the exception of seasonal testing which the commissioning agent determines should coincide with peak heating and cooling weather conditions.
- D. Related Work: All Sections in Division 23.

3.9 CONSTRUCTION WASTE MANAGEMENT

- A. As part of the sustainable construction process, construction waste may be salvaged or re-used. This is a collaborative effort and should be coordinated with the General Contractor who is responsible for administration of the construction waste management plan.

3.10 PROJECT CLOSEOUT/OPERATION AND MAINTENANCE MANUAL

- A. Electronic submittals shall be provided with accordance with all of the following conditions. Electronic submittals which do not comply with all of these conditions will be rejected without review.
 1. Electronic submittals shall be submitted in the current version of Adobe Portable Document Format (PDF)
 2. Submittals shall be original PDF's of the document and shall not be created using scanned copies of paper documents.
 3. PDF documents shall be searchable.
 4. PDF documents shall be unlocked
 5. Electronic submittals shall be separated by specification section and identified as such. Submittals which combine multiple sections into a single document will be rejected.
 6. Electronic submittals shall include a table of contents and each applicable section shall be bookmarked for easy access.
 7. Electronic submittals shall be clearly marked in RED using boxes and arrows and other appropriate markings to indicate specific product information, option selections, accessories, etc.
 8. Each product shall be keyed to the paragraph number in the specifications.
- B. Cover page shall include:
 1. Job title
 2. Date

3. Engineer
 4. Architect
 5. Contractor
 6. Construction Division
- C. Work shall be done in a print shop or bindery.
- D. Provide a master index at the beginning of the manual showing items included. Use plastic tab indexes for the sections and sub-sections of the manual.
- E. Manual shall be organized into the following five sections:
1. Contacts: This shall consist of name, address, and phone number of the following parties: Architect, Mechanical Engineer, Electrical Engineer, General Contractor, HVAC Contractor, Piping Contractor, Sheet Metal Contractor, Temperature Controls Contractor, Sprinkler Contractor, Electrical Contractor and major equipment suppliers.
 2. Equipment
 - a. Begin the Equipment section with a separate sub-section containing a list of the Division 23 equipment indicating:
 - 1) Equipment name and designation as it appears on the equipment schedule
 - 2) Area served
 - 3) Manufacturer
 - 4) Model
 - 5) Serial number
 - 6) Name plate data
 - b. The remaining sub-sections shall include, at a minimum, the following for each item of Division 23 equipment. This material shall be organized in a separate tabbed sub-section for each section of the specifications. Within each sub-section, provide separate tabs for each item of equipment, referencing the equipment schedule designation. Provide the following information as applicable:
 - 1) Performance curves or tables showing the specified operating points and the operating points after final testing and balancing
 - 2) Manufacturer's maintenance instructions: Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, maintenance and lubrication instructions, troubleshooting guides, and overhaul specifications for major equipment.
 - 3) Step-by-step procedure to follow in putting each piece of Division 23 equipment into operation
 - 4) Wiring diagram for particular equipment item
 - 5) Refer to individual specification sections for additional information required to be incorporated into the Operation and Maintenance Manual.
 3. Maintenance Schedule and Spare Parts
 - a. This shall include two sub-sections:
 - 1) The first sub-section shall consist of a preventative maintenance schedule summary table (or list). The table shall be organized by specification section and include:
 - a) Equipment name and designation as it appears on the equipment schedule
 - b) Equipment location
 - c) Type and frequency of preventative maintenance requirements (including lubrication)
 - 2) The second sub-section shall consist of a list of spare parts furnished under this contract. The list shall be organized by specification section and include (similar to that included at the end of this section):
 - a) Equipment name and designation as it appears on the equipment schedule
 - b) Spare part furnished
 - c) Verification by an Owner's Representative that the part(s) have been provided
 4. Energy Management and Controls System
 - a. Content shall be as specified in Section 23 09 23.

5. Warranties and Certifications

- a. Shall include:
 - 1) Test and balance reports
 - 2) Test records of piping, ductwork, etc
 - 3) Signed checklist of instruction period
 - 4) Copies of specific product warranties
 - 5) Copies of certified factory start-up reports
 - 6) Valve tag identification schedules
 - 7) Copy of manual describing specific maintenance services that will be furnished under this contract
 - 8) Seismic Certification
- F. Prepare two (2) printed copies in three ring binders of approved manuals for use during the instruction period.
- G. Following instruction period, turn over both printed copies and electronic files to the Owner's Representative and the Owner.
- H. Manuals may be compiled in multiple volumes if necessary for ease of use.

3.11 PROJECT CLOSEOUT/CERTIFIED FACTORY START-UP

- A. Refer to individual sections of these Specifications for specific requirements of certified factory start-up.
- B. Start-up shall be performed by a certified factory representative. Prior to start-up, certification of factory representative shall be forwarded to the Engineer for review.
- C. Start-up shall be scheduled with the owner to allow witnessing of start-up procedures by maintenance personnel. Operation and maintenance training for equipment requiring certified factory start-up shall be conducted at the time of start-up with the certified factory representative present.
- D. Certified factory start-up is required for the following equipment:
 - 1. Chemical Water Treatment
 - 2. Cooling Towers
 - 3. Variable Frequency Drives

3.12 PROJECT CLOSEOUT/OPERATION AND MAINTENANCE TRAINING

- A. General
 - 1. Two (2) training sessions shall be scheduled. The first shall occur after final inspection and prior to substantial completion. The second shall occur prior to the end of the first year of operation after acceptance. Training sessions shall be scheduled with the owner a minimum of two (2) weeks in advance.
 - 2. Instruct the Owner's representative(s) in operation and maintenance of Division 23 systems utilizing Operation and Maintenance Manual.
 - 3. Individuals present shall include the Division 23 contractors, subcontractors and equipment factory representatives as appropriate. Certified factory representatives shall be present for all equipment requiring certified factory start-up.
 - 4. The contractor's representative performing the operation and maintenance training shall locate in the building each piece of equipment included in the O&M manuals, and shall instruct to the satisfaction of the owner's representative required operation and maintenance procedures as outlined in the O&M manuals.
 - 5. Provide a digital video of the training sessions conducted and furnish copies of the video to the Owner. Digital videos shall be of sufficient quality to allow training of future employees or refresher training of personnel. Use DVD format unless directed otherwise by the owner.
 - 6. Training shall occur after final inspection and prior to acceptance by owner. It shall be scheduled with the owner, and shall occur in one consolidated session for all Division 23 equipment.

- a. Exceptions:
 - 1) Training for equipment requiring certified factory start-up shall be conducted at the time of start-up.
 - 2) Multiple sessions shall be scheduled as required to maintain a maximum allowable duration of any single session of four (4) hours.
 - 3) When separate training sessions are warranted to achieve proper training on all equipment and systems, as determined by the owner's representative, multiple sessions shall be scheduled as required.
 - 4) EMCS system training shall occur independently, and shall be in accordance with the requirements of Section 23 09 23.
 - 5) Training session shall include all equipment included in the table at the end of this section. A table similar to this one shall be used to verify owner training has been completed on all equipment, and shall be included in the Operation and Maintenance Manual.
- 7. A second training session shall occur prior to the end of the first year of operation after acceptance. Prior to this session, the owner shall submit a list of items to be covered. This session shall include all parts of the first training session necessary to meet the satisfaction of the owner, up to and including full training of all equipment and systems.

3.13 PROJECT CLOSEOUT/SPARE PARTS/MAINTENANCE MATERIALS

- A. A list of spare parts to be provided under this contract has been included at the end of this section. Refer to individual specification sections for specific requirements of spare parts to be furnished under this contract.
- B. Turn spare parts and materials over to Owner.
- C. Provide summarized list of spare parts that have been furnished. List shall include verification by owner's representative that parts have been furnished. Incorporate into O&M Manual. Spare parts list shall be similar to that provided at the end of this section.

3.14 PROJECT CLOSEOUT/96-HOUR RUN TEST

- A. The 96-hour test run shall be made when all field equipment is installed and the system is calibrated and running, and when all other building systems (including drywall, windows, doors, etc.) are complete. This period is intended to demonstrate the operation of the complete building.
- B. The 96-hour run test shall include performance of all associated software and hardware operations called for in these specifications. The test shall be for a duration of 96 continuous hours with no Contractor maintenance required. The pre-balance conference shall not be scheduled until this test has been completed satisfactorily (i.e. run without errors or alarms for a continuous 96-hour period). Notify owner's representative prior to beginning the 96-hour run test.

3.15 PROJECT CLOSEOUT/PRE-BALANCE REQUIREMENTS (REFER TO SECTION 23 05 93).

- A. Provide Balance Agency with four (4) weeks written notice prior to start of Balance.
- B. Pre-Balance Conference:
 - 1. Prior to commencing Balancing, assemble the following parties at the project site for a pre-balance conference.
 - a. General Contractor
 - b. Plumbing Foreman
 - c. Sheet Metal Foreman
 - d. Control Technician
 - e. Electrician
 - f. Balance Agency
 - g. Owner's Representative
 - 2. Submit a pre-balance checklist similar to the table at the end of this section to the Balancing Agency and the Owner's Representative at the time of the pre-balance conference indicating

- that the system is ready for balance. The table at the end of this section shall be referenced for the minimum amount of information to be included in this checklist.
3. Should it be determined at the Pre-Balance Conference that the systems are not ready for balance, the balance shall be re-scheduled and the Owner's Representative shall be reimbursed for their travel cost and time at their normal hourly rates.
 4. The Contractor shall make adjustments and changes in fan sheaves, belts, dampers and valves as required to achieve correct balance as recommended by the Balancing Agency at no additional cost to the Owner.
- C. The Contractor shall furnish the Balance Agency with a complete set of Contract Documents including drawings, specifications, shop drawings and change orders pertinent to testing and balancing.
- D. The Contractor shall perform the following tasks and provide the following items to the Balance Agency:
1. The Contractor shall put heating, ventilating, and cooling systems and equipment into full operation and continue their operation during each working day of testing and balancing for the Balancing Agency.
 2. The Contractor shall make the sheet metal foreman and control contractor available upon request to aid in troubleshooting for the Balancing Agency.
 3. The Contractor shall furnish all scaffolding, ladders, and access tools for the Balancing Agency.
 4. Make adjustments and changes in fan sheaves, belts and dampers as required to achieve correct balance as recommended by the Balance Agency at no additional cost to the Owner.
 5. Arrange access to all dampers, valves, balancing devices and operating equipment during the time that testing and balancing is to be performed.
- E. The Control Contractor shall instruct the Balance Agency in the proper procedure for setting the controls, and provide a lap computer for accessing the control system. Upon completion of Balance, the laptop shall become the property of the Control Contractor.
- F. The Control Contractor shall allow time for a control technician to assist the Balancing Agency.

3.16 PROJECT CLOSEOUT/WARRANTIES

- A. Provide specific equipment/material warranties that extend beyond 1 year project warranty period.
1. Refer to individual specifications sections for required extended warranties.
 2. Incorporate extended warranties into O&M Manual in warranties section.

3.17 PROJECT CLOSEOUT/FINAL CLEANING

- A. Clean up all equipment, materials, cartons and other debris that is a direct result of the installation of equipment under this contract.
- B. Clean exposed piping, ductwork and equipment. Repair damaged finishes and leave everything in working order.

3.18 PROJECT CLOSEOUT/RECORD DRAWINGS

- A. Provide in accordance with Division 01 and the requirements of this section.
- B. Record differences between mechanical work as installed and as shown in Contract Documents on a set of prints of mechanical drawings to be furnished by Owner's Representative. Return these prints to Owner's Representative at completion of Project. Notations made on drawings shall be neat and legible. These drawings shall not be used for any other purposes.
1. Coordination drawings and fabrication drawings may not be utilized as record drawings unless
 - a. Content from original drawings set such as notes and keynotes are transferred over to the coordination and fabrication drawings

- b. Drawings shall not be multidiscipline (ie plumbing and HVAC on same sheet) unless prepared that way in the construction documents
 - c. Drawings clearly identify deviations/modifications to the construction documents
- C. Refer to individual specification sections for additional requirements.

3.19 PROJECT CLOSEOUT/PUNCH LIST PROCEDURES

- A. The Contractor shall notify the Owner's Representative in writing when the project is ready for punch lists. The following items must be complete before punch list will be performed, and must be provided with written verification:
 - 1. Systems are complete and functional, including temperature controls.
 - 2. Testing and balancing is complete, and test and balance reports have been submitted for review.
 - 3. Operation and Maintenance Manuals are complete, and have been submitted for review.
- B. After punch lists are complete, written notice must be forwarded to the Owner's Representative requesting final checkout. Any additional trips beyond the final checkout required due to incomplete items on previous punch lists will be billed to the Contractor at normal rate plus travel expenses.
- C. At the time of initial and final observation, the project foreman shall accompany the observation party and shall remove access panels and perform other duties, as required, to allow complete observation of the entire Division 23 system.

3.20 PROJECT CLOSEOUT/MAINTENANCE SERVICES

- A. Provide a separate manual describing specific maintenance services to be provided under this contract as required under specific specification sections.

PART 4 - TABLES

4.1 COST BREAKDOWN

- A. Provide breakdown for the categories that follow. Each category shall identify separate costs for material and labor/installation.
- B. Category:
 - 1. Mobilization
 - 2. Supervision
 - 3. Site Utilities
 - 4. Cooling Towers
 - 5. Chemical water treatment
 - 6. HVAC Piping equipment: water pumps, air separators, expansion tanks etc.
 - 7. HVAC Piping
 - 8. HVAC Piping Insulation
 - 9. Air and Water Balance
 - 10. Commissioning Assistance

4.2 PRE-BALANCE CHECKLIST

Pre-Balance Checklist	
Item	Complete
General Contractor	
All doors and closures, windows and ceiling tile shall be installed	
96-hour run test complete	

Pre-Balance Checklist	
Item	Complete
Piping Contractor:	
All valves, flow meters, temperature/pressure taps installed correctly, functional and accessible	
Strainers and piping, clean, flushed, and free of debris	
Construction strainer baskets replaced with permanent baskets	
System filled to proper level and pressure reducing valve set	
Automatic and manual air vents properly installed and functional	
All air purged from system	
Water in expansion tanks at proper level	
All coils piped correctly and accessible	
Correct pump rotation	
Pumps properly aligned, grouted, and anchored	
Vibration isolators properly installed and adjusted	
Service and balance valves are open	
Electrical Contractor	
Motors wired and energized	
Proper starter and overload protection installed	
Correct fuses installed	
Motor secured to frame	
Motor bearings lubricated	

General Contractor Sign-Off: _____ Date: _____

Piping Contractor Sign-Off: _____ Date: _____

Electrical Contractor Sign-Off: _____ Date: _____

END OF SECTION

SECTION 230505
ADDITIONS OR REMODELED FACILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Phased Remodel Construction in Existing Occupied Buildings
- B. Additions to existing occupied buildings
- C. Hazardous material control within existing buildings
- D. Demolition and salvage within existing buildings

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC

1.3 PERFORMANCE REQUIREMENTS

- A. All systems shall be fully operational to the extent that they are installed at the termination of each phase of the work.
- B. System ducts and/or piping passing through existing, future, or other phase areas shall be installed, if required, to make work installed under the current phase operational.
- C. Contractor shall notify the Owner a minimum of seventy-two (72) hours in advance of any disruption to utility distribution systems.
- D. All connections to and disconnections from existing utilities such as condensate, chilled water, etc. shall be coordinated with and approved by the Owner prior to proceeding with the work. Work shall be planned so as to minimize impact to areas not involved in ongoing construction. Where areas are not involved in ongoing construction are to be impacted, the contractor shall identify such areas, the extent to which they will be affected and the period of time for which they will be affected. Provide required temporary mechanical connections to accommodate the nature of this work.
- E. The contractor is advised that the above notification and scheduling requirement may necessitate rescheduling, partial completion and reconnection, overtime work at night or on weekends or delay of the work. Contractor costs incurred due to the above shall be included in the original bid price and shall not be the cause for additional claims or charges to the Owner.
- F. All new piping shall be installed, cleaned, and tested prior to making connections to existing systems.
- G. Prior to connecting new piping to existing systems, contractor shall test the water quality in the existing hydronic systems. Submit test report to the Owner's Representative and notify the Owner's Representative if these systems do not meet the water quality conditions specified in Section 23 25 00 and request further direction. After connection of new and existing piping systems, it is intended that the entire system meet the conditions specified in Section 23 25 00. Contractor's bid for chemical treatment and charging applies to new piping systems only unless otherwise indicated.
- H. On small additions or sections of piping where it is not practical to isolate from the existing system, the Contractor may test and flush the entire system with system water or fluid. Test at operating pressure and prove tight. Replenish any fluid or chemicals lost due to flushing.

1.4 HAZARDOUS MATERIAL CONTROL

- A. Specific attention is directed to the potential of asbestos and other hazardous materials on the project. Careful coordination with other Contractors and reasonable care shall be exercised.

- B. If asbestos bearing or other hazardous compounds are encountered during the course of construction, the Contractor shall immediately notify the General Contractor/Owner's representative and wait for direction.
- C. Extent of Asbestos:
 - 1. It can be assumed that the Owner will have removed all asbestos from the construction area of this project prior to this contract.

1.5 DEMOLITION AND SALVAGE

- A. Demolition of existing mechanical systems and equipment in remodeled areas shall be provided under Mechanical.
- B. The Owner reserves first right of refusal for all materials and equipment designated for demolition or removal. All items refused by the Owner shall salvage to the Contractor.
- C. Systems and equipment to be removed and salvaged to the Contractor shall be removed from the site.
- D. Equipment and materials salvaged to the Owner shall be delivered to the Owner at on-site location.
- E. Visit the site prior to the bid date to determine the extent of required demolition.
- F. Schedule removal with the general contractor and sequence with other construction activities.
- G. If only portions of existing mechanical systems are indicated to be removed, Contractor shall cap piping and ductwork flush with walls, floors, or ceilings to allow for refinishing (where applicable).

1.6 CUTTING AND PATCHING

- A. Refer to Section 23 05 00.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Common requirements for electric motors furnished on equipment specified in other Sections, including single phase and three phase electric motors.

1.2 RELATED SECTIONS

- A. All mechanical sections with motor driven equipment
- B. Section 23 05 00 – Common Work Results for HVAC
- C. Section 23 09 23 – Direct-Digital Control for HVAC
- D. Section 23 09 95 – Variable Frequency Drives

1.3 REFERENCES

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings
- B. NEMA MG 1 - Motors and Generators
- C. NFPA 70 - National Electrical Code
- D. UL 674 - UL Standard for Safety Electric Motors and Generators for Use in Division 01 Hazardous (Classified) Locations
- E. UL 1836 - UL Standard for Safety for Electric Motors for Use in Class I, Division 02 and Class II, Division 02 Hazardous (Classified) Locations

1.4 REGULATORY REQUIREMENTS

- A. Conform to UL Component Recognition for appropriate sizes
- B. Conform to NFPA 70 and applicable State energy code

1.5 DELIVERY, STORAGE, AND HANDLING (REFER TO SECTION 23 05 00)

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (REFER TO SECTION 23 05 00):

- A. Century
- B. Baldor
- C. Marathon
- D. General Electric
- E. Westinghouse

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Motors less than 250 Watts, for intermittent service: Equipment manufacturer's standard and need not conform to these specifications.

- B. Motors which are to be controlled from a variable frequency drive shall be designed and constructed for full compatibility with the drive.
- C. Electrical Service:
 - 1. Unless indicated otherwise on equipment schedules, motors shall be supplied as with the following electrical characteristics:
 - a. Motors $\frac{1}{2}$ horsepower and smaller: 115 single phase, 60 Hz
 - b. Motors larger than $\frac{1}{2}$ horsepower shall be three phase and shall be rated as specified and scheduled
- D. Design for continuous operation in 104 °F environment.
- E. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- F. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency.
- G. Efficiency
 - 1. All motors shall meet or exceed minimum efficiency requirements of the State Energy Code.
 - 2. ECM motors shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 C.F.R 431.
 - 3. Design A and B squirrel-cage T-frame induction permanently wired three phase motors of 1 HP or more shall be "premium efficient" and shall have a nominal full-load motor efficiency no less than the corresponding values for energy efficient motors provided in NEMA standard MG-1. Exceptions:
 - a. Motors installed in space conditioning equipment that have certified SEER /EER levels. This exception is to be utilized for electrically operated unitary air conditioners and condensing units as identified in the State Energy Code.
- H. Inverter Duty Motors (For Use with Variable Frequency Drives):
 - 1. Provide where scheduled on the drawings
 - 2. Motors shall meet NEMA MG-1 Part 31 requirements. Nameplates shall state motors are "inverter duty". Motors shall be suitable for variable torque and have a 10:1 speed ratio.
 - 3. Critical vibration frequencies are not within operating range of controller output.
 - 4. Temperature rise: Class B at rated full load.
 - 5. Insulation: Minimum Class F
 - 6. Provide with shaft grounding rings. Aegis or approved equal.
- I. Wiring Terminations:
 - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 - 2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

2.3 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque
- B. Starting Current: Up to six times full load current
- C. Multiple Speed: Through tapped windings
- D. Open Drip-proof and Enclosed Air Over Enclosure: Class F insulation, rated for 311 °F maximum temperature, NEMA Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.4 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque

- B. Starting Current: Less than five times full load current
- C. Pull-up Torque: Up to 350 % of full load torque
- D. Breakdown Torque: Approximately 250 % of full load torque
- E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- F. Drip-proof and Enclosed Motor Enclosures: Class F insulation, rated for 311 °F maximum temperature, NEMA Service Factor, prelubricated sleeve or ball bearings.

2.5 ELECTRICALLY COMMUTATED MOTORS (ECM) SINGLE AND THREE PHASE POWER

- A. ECM motors shall be variable-speed, DC, brushless motors specifically designed for use with single phase, 277 volt (or 120 volt), 60 hertz electrical input. Motor shall be complete with and operated by a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. All motors shall be designed for synchronous rotation. Motor rotor shall be permanent magnet type with near zero rotor losses. Motor shall have built-in soft start and soft speed change ramps.
- B. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motor shall be direct coupled to the blower. Motor shall maintain a minimum of 70% efficiency over its entire operating range. Provide manual (or optional remote) fan speed output control for field adjustment of the flow setpoint. Inductors shall be provided to minimize harmonic distortion and line noise. Provide isolation between motor assembly and unit casing to eliminate any vibration from the fan/motor to the equipment casing. Provide a motor that is designed to overcome reverse rotation and not affect life expectancy.
- C. The equipment manufacturer shall provide a factory installed PWM controller for either manual or DDC controlled flow adjustment. The manual PWM controller shall be field adjustable with a standard screwdriver. The remote PWM controller shall be capable of receiving a 0-10 Vdc signal from the DDC controller (provided by the controls contractor) to control the flow. When the manual PWM controller is used, the factory shall preset the flow as shown on the schedule.

2.6 THREE PHASE POWER - SQUIRREL-CAGE MOTORS

- A. Starting Torque: Between 1 and 1½ times full load torque
- B. Starting Current: Six times full load current
- C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics
- D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors
- E. Insulation System: NEMA Class F or better
- F. NEMA Service Factor
- G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- I. Sound Power Levels: To NEMA MG 1
- J. Weatherproof Epoxy (where indicated) Motors: Epoxy coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

2.7 ENCLOSED MOTOR CONTROLLERS (MOTOR STARTERS)

- A. Enclosed Motor Controllers (starters) and switches are not under Mechanical unless specifically specified with a particular mechanical equipment item.
 - 1. Exception: Variable frequency drives furnished under Section 23 09 23.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- B. Check line voltage and phase and ensure agreement with nameplate.
- C. Motor starters and disconnects are not installed or furnished under Mechanical unless specified or scheduled to be factory furnished and mounted with a particular mechanical equipment item. Starters which are furnished with a particular mechanical equipment item but are shipped loose are not installed or wired under Mechanical.
- D. Variable frequency drives are furnished by Section 23 09 23 in accordance with Section 23 09 95, with installation and power wiring by Division 26. Install shaft grounding rings on all VFD controlled motors.
 - 1. Exception: Drives shall be factory furnished, mounted and wired by associated equipment manufacturer when specified.
- E. Application
 - 1. Open drip-proof enclosures (ODP) except where specifically noted otherwise.
 - 2. Totally enclosed fan cooled (TEFC) where exposed to weather or moisture.
 - 3. Unless scheduled otherwise on the drawings, provide the following motor types:
 - a. Fan motors between 1/12 hp and 1 HP shall be provided with ECM motors. Provide with controls for balancing or for remote control operations as indicated in the control drawings. Exceptions:
 - 1) Belt driven fans may use sheave adjustments for airflow balancing if not specified/scheduled to have variable frequency drives.
 - 2) Motors in the airstream of heating terminal units that only operate when providing heat to the space served.
 - 3) Motors installed in space conditioning equipment that have certified SEER /EER levels as specified in the State Energy Code.
 - 4) Motors for smoke control.
 - 5) Motors for clothes dryer booster fans
 - b. Single phase fans and blowers (shaft mounted) that do not fall under the ECM requirements above shall be permanent split capacitor type.
 - c. Single phase fans (non-shaft mounted), pumps, and air compressors that do not fall under ECM requirements above shall be capacitor start type.
 - d. Three phase motors that do not fall under ECM requirements shall be squirrel-cage type
- F. NEMA Open Motor Service Factor Schedule

HP	1800 RPM Motor
1/6 to 1/3	1.35
1/2 to 3/4	1.25
1 to 150	1.15

END OF SECTION

SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Mechanical Rubber Pipe Seals
- B. Sleeves

1.2 RELATED SECTIONS

- A. Division 3 - Cast In Place Concrete
- B. Division 7 - Thermal and Moisture Protection
- C. Section 23 05 00 – Common Work Results for HVAC
- D. Section 23 05 48 – Vibration Controls for HVAC
- E. Section 23 07 00 – HVAC Insulation
- F. Section 23 21 13 – Hydronic Piping

1.3 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. Product Data: Provide manufacturers catalog data
- B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

PART 2 - PRODUCTS

2.1 MECHANICAL RUBBER PIPE SEALS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Thunderline Corporation
 - 2. Advance Products and Systems
- B. Basis of Design: "LINK-SEAL" as manufactured by Thunderline Corporation
- C. General: Modular; mechanical type; consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between pipe and wall sleeve.
- D. Working Approach: Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. Bolts and nuts shall be of stainless steel construction. Tightening of bolts shall cause the rubber sealing elements to expand forming a watertight joint between the pipe and wall opening.
- E. Wall Sleeves: Century-Line high impact thermoplastic as manufactured by Thunderline Corp. or equal as provided by approved manufacturers. Sleeve shall have a water stop and anchor plate at least 4 inches larger than the main outside diameter.
- F. Capacities: Factory tested and designed to withstand 50 feet of water pressure with no water penetration.

2.2 SLEEVES

- A. Sleeves for Pipes through Non-fire Rated Floors: 18 gauge thick galvanized steel.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gauge thick galvanized steel.

- C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed, refer to Division 7.
- D. Sleeves for below grade piping passing under footings: Class 52; ductile iron.
- E. Sleeves for below grade piping passing through exterior walls - Mechanical Rubber Pipe Seals.
- F. Stuffing Insulation: Glass fiber type; non-combustible; 3 lb. density.
- G. Fire Safeing Sealant: Intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures beginning at 250 °F. It shall have ICBO, BOCA I approved ratings to 3 hours per ASTM E814 (UL 1479). 3M Fire Barrier Caulk, Putty, strip and sheet forms. Refer to Division 7.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 MECHANICAL RUBBER PIPE SEALS

- A. Provide in accordance with manufacturer's instructions and in accordance with details and schedules on the drawings.
- B. In general, water tight mechanical rubber pipe seals shall be provided at all piping penetrations of exterior below grade walls and exterior water vault walls and floors. See drawings for locations.

3.3 SLEEVES

- A. Provide sleeves for above grade piping penetrations of walls, roofs and floors.
- B. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction but not less than (2) pipe sizes larger than piping run. Provide for continuous insulation wrapping, where required.
- D. Where piping penetrates a roof, floor or wall, close off space between pipe and sleeve with 3 lb. Fiberglass insulation and elastomeric Sealant (air tight). This applies to all roofs, walls or floors regardless of fire rating. Note: 3 lb. insulation not required at roof penetrations. Use fire safeing sealant at penetrations of fire rated floors and walls.
 - 1. See Section 23 05 48 for supplemental requirements for penetration isolation.
- E. Provide chrome plated cast brass, one piece escutcheons at all pipe penetrations of finished surfaces (walls, ceilings, floors). Provide security set screw.
- F. Furnish and install waterproof sleeves on all piping penetrations through the floor slabs in mechanical room floor or any area where pipes pass through slabs where water spillage could cause damage to ceilings below. Top of sleeve shall extend 2 inches above floor.
- G. Sleeves are not required for core drilled holes.

END OF SECTION

SECTION 230519
METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pressure Gauges (Hydronic Service)
- B. Pressure Gauge Tappings
- C. Stem Type Thermometers and Supports
- D. Test Plugs

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Section 23 21 13 – Hydronic Piping

1.3 REFERENCES

- A. Pressure Gauges
 - 1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element

1.4 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. General
 - 1. Provide manufacturers data which indicates use, construction, operating range, total range, accuracy, and dimensions.
 - 2. Provide a Gauge Application Table indicating each different use of gauges and the gauge range to be utilized, including minimum and maximum measurement values.

1.5 OPERATION AND MAINTENANCE MATERIALS (REFER TO SECTION 23 05 00)

- A. General: Include instructions for calibrating instruments.

1.6 PROJECT RECORD DOCUMENTS

- A. Record actual locations of components and instrumentation.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instruments when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES (HYDRONIC SERVICE)

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Trerice
 - 2. Weiss
 - 3. Weksler
 - 4. Tel Tru
 - 5. Miljoco
- B. Basis of Design: Trerice Series 600CB

- C. Construction: ASME B40.1; 4½ inch dial; cast aluminum case; brass tube and socket; brass movement; painted aluminum dial with black graduations on white background; suitable for outdoor use; psi scale as appropriate for intended use; full scale accuracy of plus or minus 1 %.

2.2 PRESSURE GAUGE TAPPINGS

- A. ¼ inch NPT brass ball valve rated for 250 psig; brass pressure snubber with ¼ inch NPT connections.

2.3 STEM TYPE THERMOMETERS AND SUPPORTS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Duro
 - 2. Trerice
 - 3. Weiss
 - 4. Weksler
 - 5. Tel Tru
 - 6. Miljoco
- B. Basis of Design: Trerice Series Cx9
- C. Construction: Twelve (12) inch high, adjustable angle; blue colored organic spirit; lens front tube; UV protected clear acrylic window up to 300 °F and double strength above 300 °F; ¾ inch long NPT brass stem with 2½ inch insertion length; cast aluminum case with enamel or epoxy finish; cast aluminum adjustable joint with positive locking device; scale to suit application; well to suit service; full scale accuracy within 2 %; Fahrenheit scale as appropriate for intended use.
- D. Supports: Brass separable sockets for thermometer stems with or without extensions as required.

2.4 TEST PLUGS

- A. Test Plug:
 - 1. Manufacturers (Refer to Section 23 05 00):
 - a. Flow Design
 - b. MG Piping Products
 - c. Pete's Plugs
 - d. Sisco
 - e. Trerice
 - 2. Construction: ¼ inch NPT or ½ inch NPT brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 °F; norel core for temperatures up to 350 °F; viton core for temperatures up to 400 °F; brass extension for insulated pipe.

2.5 HYDRONIC FLOW METERS

- A. Water flow and energy meters for use in Hydronic Systems are furnished in Section 23 09 23.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in complete conformance with the manufacturer's instructions.
- B. Coil and conceal excess capillary on remote element instruments.
- C. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- D. Install gauges and thermometers in locations where they are easily read from normal operating level without crawling or climbing. Install vertical to 45 degrees off vertical.
- E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

- F. Install gauges on steam lines 45 degrees off vertical to avoid damage from intense heat.

3.2 PRESSURE GAUGES

- A. Provide pressure gauges where indicated on plans.
- B. Install pressure gauges with snubbers. Provide ball valve to isolate each gauge. Install syphon on gauges in steam systems. Extend nipples and syphons to allow clearances from insulation.
- C. Install one pressure gauge per pump, (whether indicated on the drawings or not), with taps and isolation valves. Points of connection shall be before strainers and on suction and discharge of pump; pipe to gauge.

3.3 PRESSURE GAUGE TAPPINGS

- A. Install gauge taps/test plugs in piping; refer to related piping specifications sections.
- B. At minimum, provide gauge taps/test plugs for the purposes of calibration of gauges and thermometers installed in this section and calibration of sensors installed for the Energy Management and Direct Digital Control System in Section 23 09 23.
- C. Where gauges and sensors are located at the same hydraulic and thermal point in the piping system (i.e. a pressure gauge, temperature gauge and Section 23 09 23 located together) a single test plug may be provided.
- D. Provide gauge taps/test plugs as follows:
 - 1. Adjacent to pressure gauges
 - 2. Adjacent to thermometers
 - 3. Adjacent to pressure and temperature sensors provided in Section 23 09 23
 - 4. Inlet and outlet of coil or equipment where pressure and temperature gauges are not furnished.
 - 5. Where indicated on drawings.

3.4 STEM TYPE THERMOMETERS AND SUPPORTS

- A. Provide thermometers where indicated on plans. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2½ inches for installation of thermometer sockets 24 inches on each side of the thermometer. Ensure sockets allow clearance from insulation.

3.5 TEST PLUGS

- A. Provide temperature and pressure test plugs where indicated on the plans.

3.6 METERS

- A. Install in accordance with the manufacturer's written requirements.

END OF SECTION

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SECTION 230523
GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Access Doors
- B. General Valves
- C. Spring loaded check valves

1.2 RELATED SECTIONS

- A. Division 8 – Access Doors
- B. Division 9 – Painting
- C. Section 23 05 00 – Common Work Results for HVAC
- D. Section 23 05 53 – Identification for HVAC Piping and Equipment
- E. Section 23 07 00 – HVAC Insulation
- F. Section 23 21 13 – Hydronic Piping

1.3 GENERAL

- A. All materials shall be compatible with ethylene and propylene glycol.

1.4 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. Product Data: Include data on valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.

1.6 PROJECT RECORD DOCUMENTS (REFER TO SECTION 23 05 00)

- A. Record actual locations of valves and piping.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 23 05 00.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on iron or steel valves.
- D. Provide temporary end caps and closures. Maintain in place until installation.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

- A. Materials shall be in accordance with Division 8.

2.2 GENERAL VALVES

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Bray

2. Crane
3. Grinnell
4. Hammond
5. Jenkins
6. Milwaukee
7. Nibco
8. Powell
9. Stockham
10. Walworth
11. Watts

B. Ball Valves:

1. Up to and including 2 inch: Bronze, two piece body, chrome plated ball with standard port, teflon seat, and stuffing box ring, lever handle, solder or threaded ends with union, 600 psi WG. Provide with memory stops when used as a balancing cock.
 - a. Basis of Design: Milwaukee BA-100S (threaded), Milwaukee BA-150S, (solder)

C. Butterfly Valves:

1. 2 inch and smaller: Bronze body; threaded or solder ends; Viton seat; stainless steel disk and stem; lever handle operator; memory stops when used as a balancing cock; 175 psi SWP
 - a. Basis of Design: Milwaukee, Butterball BB2-100, threaded. Milwaukee, Butterball BB2-350, solder
2. 2½ to 5 inch: Cast or ductile iron body; wafer or lug type; extended neck; threaded ends; resilient replaceable EPDM seat rated for -20 to 275 °F; aluminum bronze disc; stainless steel stem; infinite position lever handle operator with memory stop; 200 psi SWP
 - a. Basis of Design: Milwaukee MW223E (wafer). Milwaukee ML223E (lug)
3. 6 to 12 inch: Cast or ductile iron body; wafer or lug type; extended neck; resilient replaceable EPDM seat rated for -20 to 275 °F; aluminum bronze disc; stainless steel stem; gear operator with memory stop 200 psi SWP
 - a. Basis of Design: Milwaukee MW323E (wafer). Milwaukee ML223E (lug)

2.3 SPRING LOADED (SILENT) CHECK VALVES

- A. 2 inches and smaller: Bronze body; bronze trim; vertical lift; teflon seat; threaded or soldered end; MSS class 125; 125 psi SWP
 1. Basis of Design: Milwaukee 548-T (threaded ends). Milwaukee 1548-T (soldered ends)
- B. 2½ to 10 inches: Iron body; stainless steel trim; split plate; hinged with stainless steel spring; wafer style; ANSI class 125. Accessories: Flanges, bolts, nuts and gaskets
 1. Basis of Design: Milwaukee 1400 Series

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove scale and dirt on inside and outside before assembly.

3.2 INSTALLATION – GENERAL

- A. Provide valves as indicated on the drawings.
- B. Valves shall be line size unless indicated otherwise.
- C. Valves in mechanical spaces at a height greater than 8 feet shall be provided with gear operators and chain.
- D. Cooling tower isolation valves located outdoors and 5"Ø and larger, shall be provided with gear operators.
- E. Install in accordance with manufacturer's instructions and as indicated on the drawings.

- F. Provide access doors where valves and fittings are not exposed unless indicated to be provided under other divisions. Access doors shall comply with Division 8.
- G. Install valves with stems upright or horizontal, not inverted.
 - 1. Where space allows, install butterfly valves in the horizontal position or rotated 45 degrees to prevent premature failure of the liner and accumulation of debris.

3.3 INSTALLATION – VALVES

- A. Use ball or butterfly valves for shut-off and to isolate equipment, of systems, or vertical risers.
- B. Use ball or butterfly valves for throttling, bypass, or manual flow control services.
- C. For pipe 2 inch and smaller, on systems 180 °F or greater, use a ball valve in lieu of the butterfly valves.
- D. Provide spring loaded (silent) check valves where indicated on drawings and where two or more pumps are installed in parallel.
- E. Use lug end butterfly valves to isolate equipment.
- F. Use ¾ inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

END OF SECTION

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SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND FITTINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Equipment Curbs
- B. Inserts
- C. Pipe Hangers and Supports
- D. Pipe Shields and Saddles
- E. Resilient Clamps
- F. Equipment Supports

1.2 RELATED SECTIONS

- A. Division 3 - Cast In Place Concrete
- B. Division 7 - Thermal and Moisture Protection
- C. Section 23 05 00 – Common Work Results for HVAC
- D. Section 23 05 48 – Vibration Controls for HVAC
- E. Section 23 05 49 – Seismic Controls for HVAC
- F. Section 23 07 00 – HVAC Insulation
- G. Section 23 21 13 – Hydronic Piping

1.3 REFERENCES

- A. General
 - 1. ASME B31.5 - Refrigeration Piping
 - 2. ASME B31.9 - Building Services Piping
- B. Pipe Hangers and Supports
 - 1. ASTM F708 - Design and Installation of Rigid Pipe Hangers
 - 2. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer
 - 3. MSS SP69 - Pipe Hangers and Supports - Selection and Application
 - 4. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.4 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. Product Data: Provide manufacturers catalog data including load capacity.
- B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULATORY REQUIREMENTS

- A. Pipe Hangers and Supports
 - 1. Hanger and support systems shall conform to MSS SP58, MSS SP69, MSS SP89

PART 2 - PRODUCTS

2.1 EQUIPMENT CURBS

- A. Equipment curbs indicated to be under Mechanical on mechanical equipment schedules and specified herein shall be factory fabricated and shall be of the same manufacturer as the

supported equipment to ensure compatibility and size coordination. Reference associated equipment specifications and schedules for equipment curb requirements.

2.2 INSERTS

- A. Construction: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment; top slot for reinforcing rods; lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.3 PIPE HANGERS AND SUPPORTS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Grinnell/Anvil
 - 2. ERICO/Michigan Hanger
 - 3. Crane
 - 4. Fee and Mason
- B. Hydronic Piping
 - 1. Conform to MSS SP58, MSS SP69, and MSS SP89.
 - 2. Hangers for Pipe Sizes ½ to 2 inches: Carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Cold Pipe Sizes 2 inches and over: Carbon steel, adjustable, clevis.
 - 4. Hangers for Hot Pipe Sizes 2½ to 6 inches: Cast iron roll; carbon steel yoke, roll rod and hex nuts.
 - 5. Hangers for Hot Pipe Sizes 6 inches and over: Adjustable steel yoke, cast iron roll, double hanger.
 - 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and over: Steel channels with welded spacers and hanger rods, cast iron roll.
 - 8. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
 - 9. Wall Support for Pipe Sizes 4 inches and over: Welded steel bracket and wrought steel clamp.
 - 10. Wall Support for Hot Pipe Sizes 6 inches and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 - 11. Vertical Support: Steel riser clamp.
 - 12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 13. Floor Support for Hot Pipes Sizes to 4 inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 14. Floor Support for Hot Pipe Sizes 6 inches and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 - 15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Pipe Riser Clamps
 - 1. Steel and Cast Iron Pipe: Extension pipe or riser clamp; carbon steel; black or galvanized finish.
 - a. Basis of design: Grinnell Fig 261.
 - 2. Copper Pipe: Copper tubing riser clamp; carbon steel; copper finish.
 - a. Basis of design: Grinnell Fig CT-121.

2.4 HANGER RODS

- A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.5 PIPE SHIELDS AND SADDLES

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Anvil
 - 2. Fee & Mason
 - 3. M-Co

4. Pipe Shields, Inc
5. Kin-Line

B. Cold Piping:

1. Insulation protection shield type; carbon steel; galvanized finish; Anvil Fig 167.
2. For vertical pipe hanger supports, the shields shall cover the lower 40% of the circumference of the insulation.
3. For pipe installed on trapeze hangers, the shields shall extend to cover the full circumference of the pipe.
4. Shield shall be sized to suite pipe insulation thickness. High density insert furnished in section 23 07 00 and installed in this section.

2.6 RESILIENT CLAMPS

- A. Refer to 23 05 48 for supplemental requirements for penetration isolation. In the event of a conflict, 23 05 48 shall take precedence.
- B. Manufacturers (Refer to Section 23 05 00):
 1. Hydra-Zorb
- C. Construction: Resilient cushion with clamps and anchoring channel.

2.7 PIPE SUPPORTS-STRUT CHANNEL SUPPORT STANDS

- A. Manufacturers (Refer to Section 23 05 00)
 1. Unistrut
 2. MAPA
 3. Miro Industries
- B. Polycarbonate base with carbon black pigment for UV resistance or stainless steel base as required for load. Rounded edges to prevent gouging of roof membrane.
- C. Base for supports shall be single base, double base or heavy duty double base trapeze as required for weight/duty of pipe supports.
- D. Supports shall hot dipped galvanized and have adjustable heights. Heights shall allow for mounting of pipe, duct and equipment above snow levels. Supports shall allow for single or multiple pipes in for single tier or multiple tier installations
- E. All thread shall be stainless steel with size to support weight of supported pipe, duct or equipment.
- F. This support is not to be used where seismic and wind restraints are required. Refer to 23 05 49.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Piping shall be installed in such a manner that it is not in contact with metal building components.
- C. Provide neoprene or approved wrap between water piping and metal building components, unistrut or other metal.
 1. Exceptions:
 - a. Not required where piping is isolated from hangers with insulation shields.
 - b. Not required where resilient clamps are used.
- D. Concrete housekeeping pads for mechanical equipment are not under Mechanical. Coordinate required location and size with other Divisions and provide equipment shop drawings for proper sizing.
- E. Provide templates, anchor bolts, and accessories for mounting and anchoring to other Divisions as applicable.

- F. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- G. Provide rigid anchors for pipes after vibration isolation components are installed.
- H. Provide factory pre-fabricated pipe stands in accordance with the manufacturer's recommendations for piping in cooling tower yard. Piping shall be combined on a single support where possible.

3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab in concealed areas and recessed into and grouted flush with slab in exposed areas.

3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping in accordance with applicable codes and the table at the end of this section.
- B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.
- C. Place hangers within 12 inches of each horizontal elbow.
- D. Use hangers with 1½ inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide copper plated hangers and supports for copper piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. (Refer to Division 9) Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- K. Support vertical piping at every floor penetration with pipe riser clamps.
- L. Support risers independently of connected horizontal piping.
- M. Provide vibration isolation at supports when required by Section 23 05 48.
- N. Provide seismic bracing for pipes where required by Section 23 05 49.

3.4 PIPE SHIELDS AND SADDLES

- A. Provide shields and saddles to protect pipe insulation at hangers. (Furnished and installed under Section 23 05 29.)
- B. Size hangers to accommodate pipe insulation and insulation shields where applicable. See Section 23 07 00.

3.5 PIPE INSULATION INSERTS

- A. Furnished under Section 23 07 00, installed under Section 23 05 29.

3.6 RESILIENT CLAMPS

- A. Use to attach tubing, pipe, or hoses to vibrating machinery or equipment.
- B. Use to isolate piping from contact with other metals, steel partition studs.

3.7 EQUIPMENT SUPPORTS

- A. Provide supports and attachments to structure as required for installation of equipment. Supports shall be for basemounted or suspended applications to suit project conditions or as indicated on drawings.
- B. Supports shall comply with 23 05 48 and 23 05 49.

PART 4 - TABLES

Pipe Size inches	Max. Horizontal Spacing for Hangers feet		Hanger Rod Dia. inches
	Threaded or Welded Joints	Copper Tube and Piping (soldered, brazed or welded joints)	
	Steel (excluding gas)		
1/2	10	6	3/8
3/4	10	6	3/8
1	10	6	3/8
1 1/4	10	6	3/8
1 1/2	12	6	3/8
2 to 3	12	10	1/2
4 to 6	12	10	5/8
8 to 12	12	10	7/8
Notes:			
1. Vertical piping shall be supported in accordance with tables 313.3 and 313.6 of the Uniform Plumbing Code as amended by Washington state.			
2. For other piping Materials, support in accordance with the requirements of the Uniform Plumbing Code and the manufacturer's requirements.			

END OF SECTION

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SECTION 230548
VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Inertia Bases
- B. Flexible Pipe Connections

1.2 RELATED SECTIONS

- A. Division 03
- B. Section 23 05 00 – Common Work Results for HVAC
- C. Section 23 05 49 – Seismic Criteria/Controls for HVAC
- D. Division 23 piping, ductwork and equipment as specified herein.

1.3 REFERENCES

- A. 1999 ASHRAE Handbook, Vibration Isolation

1.4 PERFORMANCE REQUIREMENTS

- A. Provide minimum static deflection of isolators for equipment as indicated.
 - 1. 400 - 600 rpm: 3.5 inch
 - 2. 601 - 800 rpm: 2 inch
 - 3. 801 - 900 rpm: 1 inch
 - 4. 901 - 1500 rpm: 0.5 inch
 - 5. Over 1500 rpm: 0.2 inch

1.5 SUBMITTALS FOR REVIEW (REFER TO SECTION 20 10 00)

- A. Product Information: Provide material and type of construction. Provide schedule of vibration isolator type with location and load on each.
- B. Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

PART 2 - PRODUCTS

2.1 GENERAL ISOLATORS

- A. Manufacturers (Refer to Section 20 10 00):
 - 1. Amber Booth
 - 2. Kinetics
 - 3. Korfund
 - 4. Mason Industries
 - 5. Isolators provided by the manufacturer of isolated equipment as an accessory to that equipment are acceptable when indicated in these specifications or on the drawings to be provided with isolation equipment as an accessory to the equipment.
- B. Inertia Bases: Concrete filled base sized to support equipment without overhanging structural steel members that form perimeter framing. Concrete shall be in accordance with Section 03 30 00. Cutout in center may be provided with structural member interior section to adjust base weight if necessary. Total mass of base shall not be less than two times the total weight of all equipment mounted on base unless otherwise indicated. Submit calculations for base deflection. Deflection shall be in accordance with 1995 ASHRAE Handbook, Vibration Isolation. Furnish with preset embedded anchor bolts and pipe sleeves for fan and motor slide rail or other equipment

attachment. Size base to support suction elbow of end suction pumps and suction and discharge elbow of horizontal split case pumps, unless flexible neoprene elbows are used. Use T-shape where necessary to conserve weight and size.

1. Basis of Design: Mason Industries, type BMK/K Base

2.2 FLEXIBLE PIPE CONNECTORS

A. Flexible Pipe Connectors - Neoprene

1. Flexible neoprene connector manufactured of multiple plies of kevlar fabric and neoprene both molded and cured in hydraulic rubber presses.
2. Connector to have no steel wire, metal braiding, or rings as pressure reinforcement.
3. Straight connector to have twin-sphere cross-section.
4. Elbow connector to have single sphere cross-section forming the corner of the joint.
5. Connector with diameter less than 2½ inches may have threaded ends.
6. Connector 2½ inches diameter and larger to have floating steel flanges recessed to lock the connector's raised face neoprene flanges.
7. Connector to be installed on the equipment side of the shut-off valves.
8. Connector to be rated at a minimum of 150 psi at 220 degrees F.
9. Straight connector to be installed with twin spheres properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure.
10. Connector to be equipped with control cables with end fittings isolated from the anchoring plated by means of washers and bushings designed for a maximum of 1000 psi for sizes 8 inches and larger, operating at pressures above 100 psi.
11. Acceptable Products:
 - a. Model SFDEJ or SFU by Mason
 - b. Control Assemblies Model ACC by Mason

B. Flexible Pipe Connectors-Braided hose

1. Hydronic piping
 - a. Braided flexible stainless steel hose.
 - b. Hose to be rated at a minimum of 250 psi at 250 degrees F.
 - c. Hose to be installed horizontally and parallel to equipment shaft.
 - d. Hose to have a minimum length of 18 inches.
 - e. Hose for 2 inch pipe size and smaller to be equipped with male nipple fittings.
 - f. Hose for 2½ inch pipe size and larger to be equipped with fixed steel flanges.
 - g. Hose to be selected for operating pressure with 4:1 minimum safety factor.
 - h. Acceptable Products:
 - 1) Model BSS by Mason
 - 2) Hyspan
2. Refrigerant piping
 - a. Mason ULCPS or approved equal.
 - 1) Stainless steel braided hose with copper female sweat ends, UL approved for refrigerant service for pressures, temperatures and refrigerant type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide in accordance with manufacturer's instructions.
- B. Provide isolation for all motor driven equipment furnished in this project.
- C. Install spring hangers without binding.
- D. Connect wiring to isolated equipment with flexible hanging loop.
- E. Vibration Isolation Schedules:
 1. Flexible piping connections:
 - a. Provide neoprene connectors at all base mounted pumps.

- b. Provide braided hose connectors at all pipe connections to chillers
 - c. Provide braided hose connectors to all cooling towers.
 - d. Drain piping is excluded from the above requirements.
2. Inertia Base:
- a. Provide at all base mounted pumps on elevated slabs (not required for pumps located on slab on grade)

END OF SECTION

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SECTION 230549
SEISMIC CRITERIA FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section documents the seismic criteria that apply to this project.
- B. Seismic controls are not required for the Division 23 systems provided in this project.

1.2 QUALITY ASSURANCE

- A. Unless otherwise directed by the local authority having jurisdiction, the following codes and standards apply:
 - 1. International Building Code 2015
 - 2. American Society of Civil Engineers Standard ASCE 7-10

1.3 SEISMIC CRITERIA

- A. Seismic Factors: for more details consult structural plans
 - 1. Seismic Design Category: C
 - 2. Risk Category: II
- B. For other Seismic Criteria, such as Site Specific Site Soil Class (Mapped Seismic Acceleration (SS), Mapped spectral response acceleration at 1 second period (S1), Seismic Use Group, see the structural drawings.
- C. Mechanical System Importance Factor:
 - 1. Risk Category II
 - a. All Division 23 Pipe, Systems and Equipment, Ip=1.0
- D. In accordance with the International Building Code, the following Seismic Design Categories are exempt from Seismic Bracing of pipe, duct and equipment:
 - 1. Seismic Design Category C (SDC-C) for equipment with Ip=1.0.

END OF SECTION

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SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ceiling Tacks
- B. Nameplates
- C. Pipe Markers
- D. Tags
- E. Tag Chart

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Division 23 Piping, Valves, Equipment, and Control Sections

1.3 REFERENCES

- A. ASME A13.1 - Scheme for the Identification of Piping Systems

1.4 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. Submit list of wording, symbols, letter size, and color coding for mechanical identification of all systems and equipment.
- B. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.

1.5 OPERATION AND MAINTENANCE MATERIALS (REFER TO SECTION 23 05 00)

- A. Include valve tag identification schedule.

PART 2 - PRODUCTS

2.1 CEILING TACKS

- A. Description: Steel with $\frac{3}{4}$ inch diameter color coded head.
- B. Color code as follows:
 - 1. HVAC Equipment: Yellow
 - 2. Fire dampers / smoke dampers: Red
 - 3. Heating / Cooling valves: Blue

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved white letters on black background

2.3 PIPE MARKERS

- A. Manufacturers: (Refer to Section 23 05 00):
 - 1. W.H. Brady
 - 2. Seton
 - 3. Marking Services, Inc.

- B. Color and Lettering: Conform to ASME A13.1 and WSU Campus Standards.
- C. Plastic Pipe Markers: Factory fabricated; flexible; semi-rigid plastic; preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape; minimum 6 inch wide by 4 mil thick; manufactured for direct burial service.

2.4 TAGS

- A. Description: Brass or Aluminum with stamped letters; tag size minimum 1½ inch diameter with smooth edges.
 - 1. Provide ¼" letters for piping system abbreviation and ½" sequenced numbers. Provide 1/8" hole for fastener.

2.5 TAG CHART

- A. Description: Typewritten letter size list in aluminum frame, plastic laminated. Chart shall include valve number, service and location.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturer's recommendations.

3.2 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Provide identifying devices after completion of coverings and painting.

3.3 NAMEPLATES/LABELS

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- B. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

3.4 PIPE MARKERS

- A. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

3.5 TAGS

- A. Install tags using corrosion resistant chain. Number tags consecutively by location.

3.6 SCHEDULE

- A. Identify all scheduled equipment (pumps, boilers, heat transfer equipment, humidifiers, etc.) and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- B. Identify control panels and major control components outside panels with plastic nameplates.
- C. Identify valves in main and branch piping with tags. Exception: check valves, valves with factory-fabricated equipment units.
- D. Identify air terminal boxes with numbered tags.

- E. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow direction, and pressure (when applicable). Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- F. Provide ceiling tacks to locate valves, air terminal units and automatic (motorized) dampers above T-bar type ACT panel ceilings. Do not utilize in architectural wood or metal panel ceilings. Locate in corner of panel closest to equipment.
- G. Provide tagged valve schedule (individual to each building) to the owner.

END OF SECTION

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SECTION 230593
TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjusting, and balancing of environmental systems including but not limited to air distribution, hydronics, domestic hot water recirculating systems, pure water recirculating systems and other miscellaneous systems, and the equipment and apparatus connected thereto.

1.2 DESCRIPTION

- A. The Contractor shall secure the services of an independent Testing, Adjusting and Balancing (TAB) agency for the TAB of the mechanical systems as specified herein.

1.3 RELATED SECTIONS

- A. Division 1 – Commissioning
- B. Section 23 05 00 – Common Work Results for HVAC

1.4 REFERENCES

- A. AABC - National Standards for Total System Balance
- B. ADC - Test Code for Grilles, Registers, and Diffusers
- C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems
- D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
- E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing

1.5 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. Balancing Agency Information: Include name of balancing agency, documentation of either AABC or NEBB certifications and list of relevant project experience.
- B. Submit signed guarantee of conformance of work with either AABC or NEBB standards as outlined in the Quality Assurance section of these specifications.
- C. Submit proposed data sheets for each different type of equipment and system.

1.6 FIELD REPORTS (REFER TO SECTION 23 05 00)

- A. Submit when deficiencies in systems prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance. Indicate deficiencies in the report.
- B. Submit report prior to preparation of balancing report.

1.7 DATA SHEETS

- A. Indicate data on AABC National Standards for Total System Balance forms or NEBB forms or an exact reproduction thereof.
- B. Data sheets shall, at a minimum, indicate design and actual conditions for all information included in the equipment schedules on the drawings.

1.8 PRELIMINARY AND FINAL BALANCE REPORTS

- A. Submit two (2) draft copies of preliminary balance report for review prior to final acceptance of Project for review.
- B. Make required corrections to the TAB report and provide three (3) final copies of the balance report, one (1) for Architect/Engineer, and two (2) for inclusion in operating and maintenance manuals.
- C. Provide Architect/Engineer's final report in soft cover, letter size, securely bound manuals, complete with index page, indexing tabs, and cover identification. Reports for inclusion in the operating and maintenance manuals shall meet the same requirements, except binding shall be coordinated with the operation and maintenance manuals.

1.9 SUBMITTALS AT PROJECT CLOSEOUT (REFER TO SECTION 23 05 00)

- A. Provide final balance reports for inclusion in the operation and maintenance manuals as described above.

1.10 REGULATORY REQUIREMENTS

- A. Perform total system and equipment balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.11 QUALIFICATIONS

- A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this section with a minimum of five (5) years, documented experience.
- B. Perform work under the supervision of an AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

1.12 PRE-BALANCING CONFERENCE

- A. Convene at project site one (1) week prior to commencing work of this section, under provisions of Section 23 05 00.

1.13 COORDINATION

- A. See Section 23 05 00 for required interface between the sheetmetal, plumbing, and control contractor, and balance agency.

1.14 ACCEPTABLE TOLERANCES

- A. All systems and equipment shall be adjusted to within plus or minus 10 % of design conditions.

1.15 APPROVED AGENCIES

- A. Approved Agencies (Refer to Section 23 05 00)
 - 1. Test Comm
 - 2. Air Commander
 - 3. Or Approved Equal
- B. Agencies seeking approval for the Testing and Balancing work shall submit for approval during the bid period as specified in Section 23 05 00. The request for substitution shall contain the following information. Requests lacking this information will not be approved.
 - 1. Certification of membership with AABC or NEBB
 - 2. Representative list of projects with at least five projects of similar size and scope to this project.
 - 3. Design Engineer and Owner references - a minimum of two of each

PART 2 - (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure that the items on the pre-balance checklist are completed.
- B. Submit field reports as required to report defects and deficiencies noted during performance of services which prevent system balance.

3.2 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations.

3.3 PROCEDURES

- A. All procedures shall be in accordance with and meet all the requirements of either AABC or NEBB procedural standards. The requirements listed in this section are intended to be supplementary to the requirements of these standards.
- B. Supplemental Requirements
 - 1. Ensure recorded data represents actual measured or observed conditions.
 - 2. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
 - 3. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
 - 4. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
 - 5. At project closeout, Balancing Agency shall be represented at final observation meeting by qualified testing personnel with balancing equipment and two (2) copies of air balancing test report.
 - a. Owner's Representative may choose and direct spot balancing of one zone. Differences of 10 % or more between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire building.
 - b. Re-balancing shall be done in presence of Owner's Representative or Engineer and subject to their approval.
 - c. Spot balance and re-balance shall be performed at no additional cost to Owner. The Contractor shall compensate the Owner's Representative for additional time and expense incurred.

3.4 HYDRONIC SYSTEM WATER SYSTEM PROCEDURE

- A. Preparation of System - Phase I
 - 1. Open valves fully, including coil stop valves and return line balancing cocks. Close bypass valves.
 - 2. Examine water in system to determine if it has been treated and is clean.
 - 3. Check pump rotation.
 - 4. Check expansion tanks to make sure they are not water logged or air bound and system is full of water.
 - 5. Make certain air is removed from circulating system.
 - 6. Set controls to insure full flow thru coils and equipment. If both heating and cooling is involved, each system shall be balanced in the full flow conditions.
 - 7. Check operating temperature of boilers and other equipment.
- B. Performance of Testing and Balancing - Phase II
 - 1. Set circulating pumps to proper g.p.m. delivery.
 - 2. Adjust flow of water through boilers, heat exchangers and other equipment.

3. Check leaving water temperatures, return water temperatures, and pressure drop through equipment. Reset to correct design temperatures.
4. Upon completion of flow readings and coil adjustments, mark settings and record data.
- C. Performance of Testing and Balancing - Phase III
 1. After making adjustments to equipment, recheck settings at pumps and equipment. Re-adjust if required.
 2. Check water temperature at inlet side of cooling and heating coils. Note rise or drop of temperatures from source.
 3. Set controls to minimum position to insure flow through bypass pipes to achieve identical flow rates as that through the coils or equipment.
 4. Follow same procedure for all 3-way and bypass valves.
- D. Pumps which can deliver more than 10% over design flow at the actual system pressure experienced under installed conditions shall have impellers trimmed so that flow is 110% of design flow at full hertz. Test agency shall make recommendations to plumbing contractor regarding pump impeller changes.
- E. Check and record data at each cooling and/or heating element and circulating pump. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts. Alternatively, when parallel pumps have been provided, multiple pumps can be operated simultaneously to provide 100% design system flow provided that both pumps can be operated without damage to the system. Where pressure independent balancing valves are used, record valve information (manufacturer, size, and flow), record pressure at device, and verify it is within the range of the valve and that minimum pressures are satisfied. Fluid differential temperature across the coil shall be recorded on the balance form.

3.5 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing
 1. HVAC Pumps
 2. Cooling Towers
 3. Chillers
 4. Variable Frequency Drives
- B. Report Forms
 1. Title Page:
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency
 - c. Telephone number of Testing, Adjusting, and Balancing Agency
 - d. Project name
 - e. Project location
 - f. Project Architect
 - g. Project Engineer
 - h. Project Contractor
 - i. Project altitude
 - j. Report date
 2. Summary Comments:
 - a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate amount of building pressurization.
 - e. Nomenclature used throughout report
 - f. Test conditions
 3. Instrument List:
 - a. Instrument
 - b. Manufacturer

- c. Model number
- d. Serial number
- e. Range
- f. Calibration date
- 4. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore
- 5. Pump Data:
 - a. Identification/number
 - b. Manufacturer
 - c. Size/model
 - d. Impeller
 - e. Service
 - f. Design flow rate, pressure drop, BHP
 - g. Actual flow rate, pressure drop, BHP
 - h. Discharge pressure
 - i. Suction pressure
 - j. Total operating head pressure
 - k. Shut off, discharge and suction pressures
 - l. Shut off, total head pressure
- 6. Water Cooled Chillers:
 - a. Identification/number
 - b. Manufacturer
 - c. Capacity
 - d. Model number
 - e. Serial number
 - f. Evaporator design flow
 - g. Evaporator actual flow
 - h. Evaporator pressure drop, design and actual
 - i. Evaporator water flow rate, design and actual
 - j. Condenser pressure drop, design and actual
 - k. Condenser water flow rate, design and actual
- 7. Cooling Tower:
 - a. Tower identification/number
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Rated capacity
 - f. Condenser water flow rate design and actual
 - g. Fan RPM
- 8. Variable Frequency Drives
 - a. Mfr, size, amp rating, heater/fuse settings
 - b. Control pressure
 - c. Critical zones (top 3 driving the control pressure setpoint)
 - d. VFD speed (hz) and amps at maximum design conditions
 - e. VFD speed (hz) and amps at minimum design conditions

END OF SECTION

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SECTION 230700
HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Equipment Insulation
- B. Inserts and Shields – Installation
- C. Jackets and Fitting Covers

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Section 23 05 17 – Sleeves and Sleeve Seals for HVAC
- C. Section 23 05 23 – General Duty Valves for HVAC Piping
- D. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- E. Section 23 05 53 – Identification for HVAC Piping and Equipment
- F. Section 23 21 13 – Hydronic Piping

1.3 REFERENCES

- A. General
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
 - 3. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
 - 4. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials
 - 5. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - 6. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation
 - 7. ASTM C665
 - 8. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 9. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
 - 10. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
 - 11. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
 - 12. ASTM G22
 - 13. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials
 - 14. SMACNA - HVAC Duct Construction Standards - Metal and Flexible
 - 15. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials
- B. Glass Fiber
 - 1. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation
- C. Hydrous Calcium Silicate
 - 1. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- D. Jackets and Fitting Covers
 - 1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 2. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
 - 3. ASTM D1784 - Standard Specification for Rigid PolyVinyl Chloride (PVC) Compounds Chlorinated PolyVinyl Chloride (CPVC) Compounds

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and who is authorized by the manufacturer.

1.5 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. General
 - 1. For each insulation type, provide material characteristics, minimum and maximum service temperatures, moisture absorption characteristics, thermal and vapor transmission characteristics.
 - 2. Provide a schedule indicating insulation type and thickness for each specific pipe, equipment and duct system and installation type.

1.6 REGULATORY REQUIREMENTS

- A. General
 - 1. Conform to flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, and UL 723. This shall apply to insulation as well as to all accessories including but not limited to adhesives, mastics, jackets, cements, tapes, cloth for fittings, etc.
 - 2. Material packaging shall be clearly UL labeled for the intended purpose.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. In accordance with Section 23 05 00.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of twenty-four (24) hours.

PART 2 - PRODUCTS

2.1 CELLULAR FOAM (PIPING)

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Armstrong, Armaflex-AP
 - 2. Halstead
- B. Insulation: ASTM C534; flexible; cellular elastomeric; molded or sheet; k factor: ASTM C177, 0.27 Btu·in/(h·ft²·°F) at 75 °F; -70 °F minimum service temperature; 220 °F maximum service temperature; maximum moisture absorption: ASTM D1056, 5.0 percent (pipe) by weight; 6.0 percent (sheet) by volume; moisture vapor transmission: ASTM E96, 0.10 perm-inches.
- C. Connection: Waterproof vapor barrier contact adhesive compatible with the insulation. Armstrong 520 adhesive or approved equal.

2.2 GLASS FIBER (PIPING)

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Johns Manville, Micro-Lok, AP-T Plus

2. Knauf
3. Owens Corning
- B. Insulation: ASTM C547; rigid molded; noncombustible; k factor: ASTM C177, 0.24 Btu·in/(h·ft²·°F) at 75 °F; 850 °F maximum service temperature; 0.2 percent maximum moisture absorption by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn; bonded to aluminized film with pressure sensitive tape lap sealing system; moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- D. Provide with GreenGuard Certification for Children and Schools.

2.3 CELLULAR GLASS (PIPING)

- A. Manufacturers: Pittsburgh Corning FOAMGLAS
- B. Insulation: ASTM C552; rigid; cellular glass; molded or sheet. Insulation material and jacketing shall be the same for fittings as for pipe.
 1. k factor (ASTM C177): 0.29 Btu·in/(h·ft²·°F) at 75 °F
 2. Minimum service temperature: -10 °F
 3. Maximum service temperature: 900 °F
 4. Maximum moisture absorption (ASTM C240): 0.2% percent by volume
 5. Moisture vapor transmission (ASTM E96): 0.00 perm-inches
 6. Combustibility: Noncombustible (ASTM E 136)
 7. Flame Spread/Smoke developed (ASTM E 84): 0/0
 8. Density (ASTM C 303): 7.5 lb/cu.ft.
- C. Jacketing: PITTWRAP CW Plus
 1. 1.5 mil thick self-sealing, polymer modified bituminous compound membrane reinforced with a glass fabric and a 1 mil aluminum top film and release paper backing.

2.4 HYDROUS CALCIUM SILICATE (PIPING)

- A. Manufacturers (Refer to Section 23 05 00):
 1. Johns Manville, Thermo-12 Gold
- B. Insulation: ASTM C533; rigid molded; asbestos free; gold color; k factor: ASTM C177 and C518 0.40 Btu·in/ (h·ft²·°F) at 300 °F; 1200 °F maximum service temperature; 15 pounds/foot³ density.
- C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- D. Insulating Cement: Compatible with insulation
- E. Finish: Re-wettable fabric glass cloth with adhesive. Claremont Diplag 95 or approved equal; 15 ounces/yard²; 0.04 inches thick.

2.5 JACKETS AND FITTING COVERS (PIPING)

- A. PVC Plastic Jacket and Fitting Covers (Interior Applications):
 1. Manufacturers (Refer to Section 23 05 00):
 - a. Zeston 2000
 2. Jackets and fitting covers: ASTM D1784; one piece molded type fitting covers and sheet material; off-white color; minimum service temperature: 0 °F; maximum service temperature: 450 °F; thickness: 20 mil.
 3. Jackets and fitting covers (vapor barrier jackets): ASTM D1784; one piece molded type fitting covers and sheet material; off-white color; minimum service temperature: 0 °F; maximum service temperature: 450 °F; moisture vapor transmission - ASTM E96 - 0.002 perm-inches; thickness: 20 mil.
 4. Connections: Pressure sensitive color matching vinyl tape
- B. Aluminum Jacket (Exterior Applications): ASTM B209

1. Manufacturers (Refer to Section 23 05 00):
 - a. Childers
 - b. Pabco
2. Jacket: Thickness: 0.020 inch sheet; finish: embossed; joining: Longitudinal slip joints and 2 inch laps.
3. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.6 INSULATION INSERTS FOR PIPE SHIELDS AND SADDLES

- A. Insulation Inserts:
 1. At pipe shields:
 - a. Extra heavy density insulation which will not crush from weight of pipe.
 - b. Thickness same as scheduled for pipe insulation
 - c. Cover no less than 40% of the circumference of the insulation for pipe supported from hangers. Cover 100% of the circumference of the pipe for pipe supported on trapeze.
 - d. Pittsburgh-Corning Foamglas, Calcium Silicate or approved equal.
 - e. Length to match shield length. Coordinate with section 23 05 29.
 2. At Saddles
 - a. Pittsburgh-Corning Foamglas, Calcium Silicate or approved equal.
 - b. Pre-cut pipe insulation to fit within saddle to maintain insulation integrity of pipe at the saddle location.
 - c. Lengths to match saddle length.
- B. Inserts: Heavy density insulation which will not crush from weight of pipe. Locate between shield and pipe. Inserts are furnished in this Section 23 07 00 and installed in Section 23 05 29.
- C. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and insulation. Shields are furnished and installed under Section 23 05 29.

2.7 GLASS FIBER (EQUIPMENT)

- A. Manufacturers (Refer to Section 23 05 00):
 1. Johns Manville - Pipe and Tank Insulation
 2. Owens Corning
- B. Insulation: Semi-rigid, noncombustible; *k* factor: ASTM C335 0.27 Btu·in/ (h·ft²·°F) at 75 °F; maximum service temperature: 650 °F; density: 3.0 pounds/foot³.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film with pressure sensitive tape lap sealing system; moisture vapor transmission: ASTM E96; 0.02 perm-inches.

2.8 LACE-ON BLANKETS

- A. Manufacturers (Refer to Section 23 05 00):
 1. Insulation
 - a. Kaowool Cerablanket
 2. Fabric
 - a. JP Stevens Glass-Tex Fabric Style 9987
 - b. Alpha Maritex Style 3200-SA
- B. Materials: 0.008 inch thick type 304 stainless steel knitted wire mesh inner liner 8 pounds/foot³ density insulation, ½ inch thick; oil and water resistant exterior protective fabric.
- C. Construction: Blankets shall be sewn together. Lacing anchors shall be 2½ inch stainless steel secured with 12 gauge stainless steel washers. Blankets shall have stainless steel wire installed for draw cords.

2.9 REUSABLE VALVE COVERS (HYDRONIC PIPING) (INDOOR ONLY)

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. No Sweat Valve Wraps
- B. Product shall be engineered for a wide variety of valves including strainers, automatic balancing devices, circuit setters, ball valves, butterfly valves, control valves and check valves. Product consists of outer jacket, closure assembly and fiberglass insulation.
- C. Outer jacket shall be made of material equal to DuPont Tychem® QC, overlapping and completely covering the insulation with seams joined by tabs made from hook and loop fasteners (Velcro). Butt ends shall have sewn-in-place elastic. Weight of 2.5 oz per square yard, 10 mils thickness, 0.01 Perms water vapor transmission, 65 psi Mullen burst strength, white/glass finish, UV resistant
- D. Outer jacket shall overlap adjoining sections of pipe insulation.
- E. Installation shall not require the use of any special hand tools.
- F. Suitable for continuous operation at 200 degrees Fahrenheit with insulation insert blankets
- G. Fire and smoke performance: Flame spread less than 25, smoke developed less than 50 per ASTM E84.
- H. Insulation Inserts: Fiberglass k-factor 0.26 per inch (ASTM C77). Provide 1 or more layers to meet or exceed minimum insulation thickness requirements as indicated in pipe schedules in Part 4 of this specification.

PART 3 - EXECUTION

3.1 EXAMINATION – GENERAL

- A. Verify that piping and ductwork has been tested and approved before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION – GENERAL – (PIPING)

- A. Continue insulation with vapor barrier through penetrations.
- B. On exposed piping in finished areas, locate insulation and cover seams in least visible locations.
- C. Insulate pipes in accordance with the insulation schedule.
- D. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections and expansion joints.
- E. On insulated piping without vapor barrier for pipes conveying fluids 180° F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.
- F. Install materials in accordance with the manufacturer's instructions.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- H. Insulation on all cold water systems shall be applied with a continuous unbroken vapor seal. Do not allow hangers, supports, anchors etc., to come in direct contact with the pipe.
- I. Insulate entire system including fittings, unions and flexible connections, flanges and expansion joints. For insulation of valves and other pieces of equipment, see Section 23 07 00. At fire separations, Refer to Section 23 05 17 and Division 7 - Fire Stopping.
- J. Heat Traced Piping: Insure that any required heat trace is installed prior to insulation. Heat trace is not provided under Mechanical. Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.

3.3 GLASS FIBER INSULATION (PIPING)

- A. Cover pipe with glass fiber insulation in thickness scheduled.
- B. When vapor barrier is required, adhere factory applied vapor barrier jacket lap smoothly and securely at longitudinal laps with pressure sensitive strip. Adhere self-sealing butt joint strips over end joints. No staples will be allowed.
- C. Insulate fittings and joints with molded insulation of like material and thickness of adjacent pipe with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
- D. Cover insulation with one piece PVC fitting covers.

3.4 JACKETS AND FITTING COVERS (PIPING)

- A. Apply insulation prior to installation of jackets and fitting covers.
- B. Pipe exposed in tunnels, thermoplastic pipe located outdoors, and insulated pipe located outdoors and insulated pipe penetrations through exterior walls: finish with aluminum jacket and fitting covers.
- C. Pipe exposed in finished spaces less than 10 feet above finished floor, and where indicated on drawings: finish with PVC jacket and fitting covers.
- D. Secure PVC jackets and fitting covers with stainless steel tacks and wrap seams and tacks with vinyl tape.
- E. Install aluminum jackets located outdoors with seams located on bottom side of horizontal piping. Apply sealing compound and closures to make weathertight.

3.5 INSERTS AND SHIELDS

- A. Insulation inserts are furnished in this section and provided to section 23 05 29 for installation.
- B. Install finished piping insulation tight to inserts with tightly fitting butt joints. Maintain continuous vapor barrier and jacketing at pipe joints

3.6 INSTALLATION – GENERAL – (EQUIPMENT)

- A. General
 - 1. Provide materials in accordance with the manufacturer's recommendations.
 - 2. Factory Insulated Equipment: Do not insulate.
 - 3. Finish insulation at supports, protrusions, and interruptions.
 - 4. Nameplates and ASME Stamps: Bevel and seal insulation around with a mastic. Do not insulate over.
 - 5. Exposed Equipment in Finished Areas: Locate insulation and cover seams in least visible locations.
 - 6. Cover field insulated tanks with aluminum jackets.
- B. Hydronic Valve Covers: For indoor hydronic valves requiring access for maintenance, repair or cleaning: Insulate with reusable valve covers. Install insulation in single or multiple layers to match scheduled insulation thickness.

3.7 CELLULAR FOAM (EQUIPMENT)

- A. For equipment not requiring access for maintenance, repair or cleaning.
- B. Cover equipment in thickness scheduled.
- C. Insulation shall fit in snug contact with equipment and be installed in accordance with the manufacturer's recommendations.
- D. Seal joints in insulation with adhesive.

- E. Stagger joints on layered insulation.
- F. Paint exterior exposed insulation with two coats of gray finish recommended by the Insulation Manufacturer to protect from weather or sunlight.

3.8 GLASS FIBER (EQUIPMENT)

- A. For equipment not requiring access for maintenance, repair or cleaning.
- B. Cover equipment with glass fiber insulation in thickness scheduled.
- C. Provide vapor barrier jackets. Adhere factory applied vapor barrier jacket lap smoothly and securely at longitudinal laps with pressure sensitive strip. Adhere self-sealing butt joint strips over end joints. No staples will be allowed.

3.9 LACE-ON BLANKETS

- A. Provide for equipment requiring access for maintenance, repair, or cleaning: insulate with lace on blanket.
- B. Install in single or multiple layers to match scheduled insulation thickness for associated piping system.
- C. Blankets shall be removable and reusable.

PART 4 - SCHEDULES

4.1 SCHEDULES

- A. Insulate heating and cooling equipment including valves, tanks, traps, convertors, radiant ceiling panels, air removal devices, flash tanks, condensate receivers, etc.
- B. Insulate pumps which deliver fluid below ambient temperature.
- C. Equipment, tanks, etc., not factory insulated, shall be insulated under this section.
- D. Expansion tanks and similar equipment not receiving fluid directly from the system do not require insulation.
- E. Valves, traps, pressure reducing valves, pumps, convertors, expansion joints, etc.: Extend insulation 6 inches beyond flanges.
- F. Systems above Ambient Temperature: 2 inch thick glass fiber insulation with vapor barrier.
- G. Systems below Ambient Temperature: ½ inch thick glass fiber insulation with vapor barrier. Exception: Insulate pump bodies on systems below ambient temperature with 1 inch thick cellular foam insulation.
- H. All equipment requiring access for maintenance, repair or cleaning shall be insulated with lace-on blankets.

Insulation Schedule - Piping					
System	Operating Temperature (degrees F)	Insulation Type	Pipe Size (inches)	Minimum Insulation Thickness (inches)	Notes
Condenser Water (Outdoors)	—	glass fiber k =.21 - .27	Under 1 ½	0.5	
			1 ½ and greater	1.0	
Notes:					

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SECTION 230923
DIRECT-DIGITAL CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Energy Management and Control System (EMCS)
- B. Water Flow Meters
- C. Controllers
- D. General Components

1.2 RELATED SECTIONS

- A. Section 22 05 23 – General Duty Valves for Plumbing Piping
- B. Section 22 10 00 – Plumbing Piping
- C. Section 23 05 00 – Common Work Results for HVAC
- D. Section 23 05 05 – Additions or Remodeled Facilities
- E. Section 23 05 23 – General Duty Valves for HVAC Piping
- F. Section 23 05 53 – Identification for HVAC Piping and Equipment
- G. Section 23 05 93 – Testing, Adjusting, and Balancing
- H. Section 23 09 95 – Variable Frequency Drives
- I. Section 23 21 13 – Hydronic Piping
- J. Section 23 21 23 – Hydronic Pumps
- K. Section 23 25 00 – HVAC Water Treatment
- L. Section 23 65 00 – Cooling Towers

1.3 REFERENCES

- A. UL 916 - Underwriters Laboratories Standard for Energy Management Equipment
- B. NEC - National Electrical Code
- C. City, county, state, and federal regulations and codes in effect as of date of purchase
- D. For projects with smoke control requirements, the DDC system shall be fully compliant with NFPA guidelines 92A and 92B for smoke control. System hardware shall be UL 864-UUKL listed for smoke control.

1.4 DESCRIPTION

- A. The specification is intended to cover equipment, labor, materials and services sufficient to result in a complete Energy Management and Control System (EMCS) capable of controlling and monitoring the complete mechanical system with owner training as outlined in the drawings and in these specifications.
- B. EMCS contractor shall be responsible for all EMCS and temperature control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes and Division 26. This includes all low voltage wiring as well as line voltage wiring required for control power purposes.

1.5 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. General
 - 1. Drawings shall be standard sizes: 8½×11 inch, 11×17 inch, 24×36 inch.
- B. Provide temperature controls submittals with the following tabbed sections:
 - 1. Statements of Conformance Section
 - a. Statement of Conformance: The temperature controls submittal shall be accompanied by a statement of conformance by the temperature controls supplier. This statement of compliance shall indicate that the EMCS, as installed, will meet all of the requirements of these specifications. If the EMCS is not capable of meeting each requirement of these specifications, this statement of compliance shall indicate each individual requirement that cannot be met, the impact this might have on the system, and proposed methods of equivalent compliance.
 - b. Statement of Native BACnet Conformance: The temperature controls submittal shall be accompanied by a separate statement of native BACnet conformance by the temperature controls supplier. This statement of compliance shall indicate that the EMCS, as installed, will meet all of the requirements of the specified conformance class of native BACnet architecture. Included with this statement shall be Protocol Implementation Conformance Statements (PICS) for each applicable component necessary to demonstrate compliance.
 - 2. Floor Plan Wiring and Component Section
 - a. Provide floor plans that indicate the location of primary control components such as operator work stations, equipment controllers/main panels, unitary (terminal unit) controllers, and associated controlled equipment (boilers, chillers, air handlers, etc.).
 - b. Provide a network communications (LAN) wiring diagram showing connectivity between control devices.
 - 3. System Interface Section
 - a. Provide graphic systems schematics and flow diagrams.
 - b. Provide a complete points list, indicating the plain English description that will be utilized in EMCS programming and the type of point (analog input, analog output, digital input, digital output).
 - c. Provide a complete list of adjustable points, including range of adjustment and initial setting.
 - d. Provide a complete list of alarms, including level of alarm and resulting action.
 - e. Provide a description of the sequences of operation as understood by the controls contractor. This description shall be in the general format of the programming for the controls system, but shall be in narrative form. Copied sequences from the control diagrams are not acceptable.
 - 4. System Wiring Diagram Section
 - a. Provide a system schematic layout showing all operators' terminals, equipment controllers, unitary controllers, equipment and systems interface devices, etc. as required for a complete system. The equipment served by each device shall be indicated in the schematic. Individual inputs and outputs shall not be included in this schematic. Each device shown in this schematic shall be cross-referenced to both the individual component schematic as well as the submittal information for that device type. Wiring between devices shall also be cross-referenced to its submittal information.
 - b. Provide individual component schematics for each controller. These schematics shall indicate each device input and output. The available number and type of spare points for each controller as installed as well as the expandability of the device shall be indicated in the schematic.
 - 5. EMCS Software Section
 - a. At a minimum, this section shall address each requirement noted in these specifications for the EMCS software.
 - 6. Graphical User Interface Section
 - a. Provide a representation of the graphical penetration scheme as outlined in these specifications. This can be in the form of a simple flow diagram.

- b. Provide a representation of how points and schedules are accessible through the graphical interface.
 - c. Provide a representation of how the system programming is accessible through the graphical user interface.
 - d. Provide information on the graphics development package.
 - e. Provide graphic floor plan displays for all spaces. Include a representation of each of the required space temperature indicators.
 - f. Provide a table of occupied heating, occupied cooling, unoccupied heating and unoccupied cooling setpoints for each temperature control zone. Setpoint criteria shall be obtained from the owner prior to submission of submittals. This table shall be a verification of these criteria.
 - g. Provide a table of the warm-up/pre-cool, occupied and unoccupied scheduling for each temperature control zone. Scheduling criteria shall be obtained from the owner prior to submission of submittals. This representation shall be a verification of these criteria.
- 7. Web Browser Interface Section
 - a. At a minimum, this section shall address each requirement noted in these specifications for the EMCS software.
- 8. Interface Wiring Diagrams Section
 - a. Provide schematics for each point of interface to other systems or packaged equipment controls.
 - b. For interfaces not specified to receive integration devices, provide the following at a minimum:
 - 1) Schematics showing the location of all terminal strips and/or connection points between systems (including room designation, location within room, control panel designation, etc. as appropriate).
 - 2) Notation of contractor responsible for hardware (terminal strips, contacts, etc.), wiring and terminations.
 - 3) A description of each point including plain English functional description, electrical characteristics (0 to 10 V, 4 to 20 mA, N/O dry contact, N/C dry contact, etc.).
 - c. For interfaces specified to receive integration devices, provide the following at a minimum:
 - 1) Schematics showing the location of the integration device (including room designation, location within room, control panel designation, etc. as appropriate).
 - 2) Notation of contractor responsible for integration device, wiring and terminations.
 - 3) A description of the information that will be transferable through the integration device, including read/write capabilities.
 - d. Each schematic shall be reviewed, approved and noted as such by both the temperature controls contractor and an authorized agent of the system or equipment requiring interface.
 - e. At a minimum, a wiring diagram shall be provided for each interface noted in the Systems and Equipment Interfaces section of these specifications.
- 9. Components Section
 - a. Provide submittal information for each system hardware component, including the operator's terminal, all controllers, required systems and equipment interface devices, measurement and control devices. Measurement devices shall include units of measurement, range of measurement and accuracies.
 - b. Provide a control damper and damper actuator sizing schedule.
 - c. Provide a control valve sizing schedule.
 - d. Provide a complete recommended spare parts list for the controls system.
- C. Submit a Material Safety Data Sheet (MSDS) for each sealant, adhesive, coating, paint in accordance with Section 23 05 00.

1.6 PROJECT RECORD DOCUMENTS (REFER TO SECTION 23 05 00)

- A. Provide "as-built" documentation of all information required for original system and equipment submittals as outlined above. Information shall be included in the operation and maintenance manuals as outlined below.
- B. In addition to inclusion in the operation and maintenance manuals, the points list, adjustable points list, and alarm points list, as required in the systems control section of the submittals, shall be laminated in plastic after approval by Owner's Representative. One copy shall be posted at the main control cabinet of the building and the second copy shall be given to the Owner.
 - 1. Points list shall identify BACnet information and address for each point for use in the future by other BACnet manufacturers.

1.7 OPERATION AND MAINTENANCE DATA (REFER TO SECTION 23 05 00)

- A. The Energy Management and Controls System section shall include the following sub-sections:
 - 1. An individual section for each system. These sections shall include as-built documentation of the information required in the Systems Interface section of the submittals.
 - 2. Systems Wiring Diagrams Section. This section shall include as-built documentation of the information required in the Systems Wiring Diagrams section of the submittals.
 - 3. Interface Wiring Diagrams Section. This section shall include as-built documentation of the information required in the Interface Wiring Diagrams section of the submittals.
 - 4. Components Section. This section shall include as-built documentation of the information required in the components section of the submittals.

1.8 DELIVERY, STORAGE, AND HANDLING (REFER TO SECTION 23 05 00)

- A. Store products in shipping containers in clean, dry location until installation.
- B. The Contractor shall be responsible for his work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

1.9 QUALIFICATIONS

- A. Manufacturer's/Control Contractor's Qualifications: The EMCS Contractor shall be a firm that is a factory authorized representative of the manufacturer of the automation and control equipment products, and that is experienced in the design and installation of systems similar in nature to this project, with a record of successful in-service performance.
 - 1. The EMCS Contractor shall have an office located within 100 miles of Spokane, WA and shall have at least five (5) years presence of successful project experience in the surrounding area through the same office.
 - 2. The EMCS Contractor shall have successfully designed and installed a minimum of three (3) projects of similar size and complexity.
 - a. Submit project titles, descriptions and contact personnel references (name and phone number) of listed projects.
- B. Installer Qualifications: Building automation and temperature control work shall be done by specialty mechanics in the employ of an EMCS contractor who specializes in this work and are factory trained to install the products of the manufacturer of the automation and control equipment. Installer shall have previous experience installing and programming BACnet system and controllers.
- C. Project Manager/Engineer's Qualifications: The qualifications of the EMCS Contractor's proposed project manager/engineer shall be submitted in writing within the time frame of the submittals. The EMCS Contractor's engineer shall have a minimum of five (5) year's experience in the automation and control field with the same company furnishing the work, as well as having been involved in the design and construction of three (3) projects of similar size and scope. The Owner reserves the right to approve the proposed project engineer from the control contractor's staff. The project

manager/engineer shall be designated as a key personnel and shall remain assigned to the project through its entire duration of submittals, construction and warranty. The project manager shall be the contactor's and Owner's primary contact.

- D. The EMCS Contractor shall have local emergency service available on a 24 hour, 7 day-a-week basis, with a normal response time from contact to arrival on site of not more than two (2) hours.

1.10 SYSTEM DEMONSTRATION

- A. The Owner reserves the right, at their option, to require a demonstration by a factory authorized representative of the control system prior to acceptance of any temperature control bid.
- B. This demonstration shall occur at the project site and shall include a functional demonstration and complete description of the control system as bid including, but not limited to, a list of representative projects, software routines, hardware components, sequences of operation, programming and troubleshooting techniques, and availability of service and training.

1.11 SEQUENCING AND SCHEDULING

- A. Complete the 96-hour test run (see Part 3 of this section) prior to test and balance.
- B. Pre-balance inspection and adjustment of the control systems shall be performed by the control engineer in the presence of the Engineer. This operation shall be performed prior to the start of the air and water balance work. Pre-balance inspection and adjustment shall include adjustments of all controls and devices as required to prove sequence of operation in all control modes. A written report, signed by participating parties shall be forwarded to the Owner's Representative with a copy enclosed in the O&M manual.
- C. The temperature controls contractor shall assist the balancing agency as required for proper balancing of the systems with assistance as required in Section 23 05 93. Furnish a hand-held controller or laptop service tool for the balance agency use during test and balance. This tool shall be returned to the EMCS Contractor at the end of test and balance.
- D. Final adjustments and calibration of systems and components, including valve and damper operators, shall be accomplished after balancing has been completed and prior to O&M instruction period. This shall include any required setting of controls or labeling of setpoints. The EMCS Contractor shall coordinate scheduling and setpoints with Owner's Representative. A letter of certification, stating the above has been completed and signed by the EMCS Contractor shall be forwarded to the Owner's Representative with a copy enclosed in the O&M manual. The Owner's Representative shall be notified, in writing, two (2) weeks in advance of scheduled time to witness sequence of operation on all systems. All systems shall be fully operational at the time of this demonstration.
- E. See Section 23 05 00 for additional requirements.

1.12 COORDINATION WITH OTHER TRADES

- A. It is the responsibility of the EMCS contractor to communicate all specific needs for proper installation and operation of the EMCS system to all other necessary trades and to verify that those provisions will be made under the terms of this contract without additional cost to the owner.
- B. Coordinate closely with other subcontractors and equipment suppliers to ensure that equipment is provided with features necessary to interface with the EMCS system.
- C. Coordinate and schedule work with all other work in the same area or with work which is dependent upon work by other trades to facilitate mutual progress.
- D. The EMCS Contractor's designated project engineer/manager shall attend the regularly scheduled construction meetings as requested by the General Contractor in response to current construction activities and shall be familiar with the technical aspects of the EMCS design and capabilities.

1.13 NATIVE BACNET SYSTEM REQUIREMENTS

- A. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, equipment controllers, unitary controllers, and operator devices while re-using the existing controls equipment.
- B. The EMCS shall utilize native BACnet architecture as referenced by ANSI/ASHRAE Standard 135-most recent edition.
- C. The communication network between controllers shall be BACnet. All controllers shall utilize native BACnet architecture and shall be independently tested and listed through BACnet Testing Laboratories. See <http://www.bacnetassociation.org/btl>.
- D. All points need to be configured so that a "future" BACnet vendor can read/write to all points from a central Owner Work Station for such tasks that would include, but not be limited to, changing setpoints, making adjustments and scheduling of equipment.

1.14 SYSTEMS AND EQUIPMENT INTERFACES

- A. General: Provide interfaces/integration with these microprocessor-based systems and packaged equipment as indicated on the control drawings. Coordinate closely with the respective subcontractors and their equipment suppliers to ensure that the necessary interface is provided with each piece of equipment.
- B. The functions of the controls added as part of this project shall fully integrate into the existing campus' EMCS system.

1.15 COMMISSIONING REQUIREMENT

- A. See Section 23 05 00 for commissioning requirements related to this section of work.

1.16 ENERGY CODE COMPLIANCE

- A. The EMCS shall comply with all requirements of the current Washington State Energy Code.

PART 2 - PRODUCTS

2.1 ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS)

- A. Native BACnet System Manufacturers (Refer to Section 23 05 00 and this section paragraph 1.9 A).
 - 1. Siemens Building Technologies
 - 2. No Approved Equal
- B. Operator's Terminal
 - 1. Operators terminal is existing in a central campus location. Upgrade hardware and software as required to suit this project and software updates.
- C. EMCS Software
 - 1. General
 - a. The EMCS contractor shall provide all software required for efficient operation of the EMCS system. Software shall be modular in design to provide maximum flexibility, expansion, and future revision of the system. All functionality described herein shall be regarded as a minimum.
 - 2. Control Algorithms: The system shall have the ability to perform the following pre-tested control algorithms: Two-position control, proportional control, proportional plus integral control, proportional, integral, plus derivative control, and automatic tuning of control loops.
 - 3. Operator Access: Different security levels shall be assignable to each operator. Each command and event shall be capable of being assigned a security level. Access to commands, acknowledgment of alarms, etc. shall be limited in accordance with the operator's security level designation.

4. Password Protection: Multiple operator-specific password access protection shall be provided to allow the user/manager to limit workstation control.
5. Event Reporting: The operator shall have the capability to define which actions get reported in which manners, both individually and globally through grouping of events (initially, a minimum of three (3) reporting groups shall be designated: urgent alarms, general alarms, and general messages). Reported events shall include a time and date stamp, site location and network address, and alpha-numeric event ID. Any one or combination of the following event reporting actions shall be assignable to each event: ASCII file, numeric pager (pages personnel by sending numeric messages to personal pagers through the use of a third-party service), printer, and operator's terminal.
6. Trending: Any point, physical or calculated, shall be capable of trending. Collection of data shall be definable by either pre-defined time intervals or pre-defined changes of value. Trending information from anywhere in the system shall be available at the operator's terminal without requiring intervention by an operator.
7. Scheduling: The system shall be capable of scheduling by zone, individual equipment, groups of zones or equipment, building area, and systems. Equipment or zone groups shall be definable by the operator. Weekly schedules shall incorporate seven (7) independent daily programs. System shall also incorporate one-time and annual event scheduling. The system shall automatically update for daylight savings time and leap years. Schedules shall be capable of being overridden at the operator's terminal.
8. Optimum Start/Stop: Start and stop equipment on a sliding schedule based on the individual zone temperature and the heating/cooling capacity of the equipment serving that zone. The heating/cooling capacity value shall be operator adjustable.
9. Source Temperature Optimization: Automatically perform source temperature optimization for all equipment noted to have temperature setpoints reset by system demand in the control diagrams. Capability shall include resetting of temperature setpoints in accordance with user-adjustable parameters as well as starting and stopping of primary mechanical equipment based on zone occupancy and/or zone load conditions. Temperature optimization loops shall be tuned to minimize cycling and maximize system stability.
10. Demand Limiting: The system shall be capable of measuring electrical usage from multiple meters serving one building. Each piece of equipment being controlled shall be programmable to respond to peak demand information. The demand control function shall utilize a sliding window method with the operator being able to establish the kilowatt threshold for a minimum of three (3) adjustable demand levels. The operator shall have the capability to set the individual equipment temperature setpoints for each operator defined demand level. Equipment shall not be shed if these reset setpoints are not satisfied. The system shall have failed meter protection, generating an alarm upon loss of KW signal. System shall archive demand and usage information. Information shall be retrievable by day, month-to-date and year-to-date basis.
11. Night Setback: The system shall allow the space temperature to drift down or up within an adjustable unoccupied temperature range. Heating and/or cooling shall be controlled to maintain the night setback range during the scheduled night setback periods.
12. Timed Local Override: When provided with occupant override capabilities the system shall permit the override of equipment which has been scheduled off. Override history shall be maintained for each timed local override input point. Local override shall allow system operation for up to 2 hours.
13. Economizer: The system shall be capable of switchover from mechanical cooling to economizer cooling based on outside air temperature. Economizer operation shall be capable of being overridden by the operator.

D. Graphical User Interface

1. Floor Plan and System Selection/Penetration: The operator interface shall allow users to access the various system schematics and floor plans via both a graphical penetration scheme and menu selection.
 - a. Graphical penetration scheme: Multiple floor plan displays, when required, shall all be accessible from a single initial screen. System schematics shall be directly accessible

from the floor plan display for the area they serve. For zoned systems, both the zone and main system schematics shall be accessible from the floor plan display. For systems that interact with secondary systems and/or equipment (e.g. an air handling unit with a hot water coil served by a heating water system), the secondary system and/or equipment shall be accessible from the primary system schematic. It is the intent of this graphical penetration scheme that, from a single screen, any location served by the system can be accessed and, from any floor plan display, all systems and/or equipment serving that area can be accessed.

- b. Menu selection: A menu selection shall also be available to the operator, similar in nature and layout to the graphical penetration scheme described above.
2. Floor Plan Displays: Provide color graphic floor plan displays designating each temperature control zone. Each zone shall have a graphic and color-coded indication of space temperature relative to setpoint, with a minimum of five (5) different indicators (e.g. dark blue, light blue, green, yellow, red).
3. System Schematic Displays: Provide color graphic system schematics for all mechanical equipment and systems. Schematics shall be similar in nature to the control diagrams included in the drawings. Each system and/or equipment schematic shall include the following minimum information:
 - a. System designation
 - b. Graphic representation and labeling of all major equipment and components (all scheduled equipment as a minimum)
 - c. Current status of all I/O points applicable to the system (located appropriately for ease of proper association)
4. System Setpoint and Scheduling Adjustments: All system setpoints and schedules shall be adjustable through the graphic interface. This includes all space temperature setpoints, occupied/unoccupied/warm-up schedules, and all points noted in the control diagrams as adjustable. Adjustments shall require only mouse operation and entering of new values. Changes shall be automatically transferred to the appropriate control module.
5. Windowing: The windowing environment of the operator's terminal shall allow the user to simultaneously view several graphics at the same time to analyze total building operation, or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
6. Programming Accessibility: Programming for sequences of operation shall be accessible through the graphical user interface.
7. Setpoint Accessibility: Each setpoint and/or item indicated in the control diagrams to be adjustable shall be accessible and capable of being modified through the graphical user interface.
8. Graphics Development Package: Graphic generation software shall be provided to allow the user to add, modify, or delete system graphic displays.
 - a. The contractor shall provide libraries of pre-engineered screens and symbols depicting standard HVAC components (e.g. fans, cooling coils, filters, dampers, etc.) and electrical symbols.
 - b. The graphic development package shall use a mouse or similar pointing device in conjunction with a drawing program to allow the user to perform the following:
 - 1) Define symbols
 - 2) Position and size symbols
 - 3) Define background screens
 - 4) Define connecting lines and curves
 - 5) Locate, orient and size descriptive text, define and display colors for all elements
 - 6) Establish correlation between symbols or text and associated system points or other displays
 - c. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout, or any other logical grouping of points which aids the operator in the analysis of the facility. To accomplish this, the user shall be able to build graphic displays that include point data

from multiple DDC panels, including application specific controllers used for DDC unitary or VAV terminal unit control.

E. Web Browser Interface

1. **Compatibility:** The system shall be capable of supporting an unlimited number of clients using Internet Explorer. Web browser software shall be compatible with the operating system and system configuration provided.
2. **Consistency with GUI:** Graphical screens developed for the GUI shall be the same screens used for the web browser client. Any animated graphical objects supported by the GUI shall be supported by the web browser interface. The browser shall provide the same view of the system as the graphical user interface including graphics, schedules, calendars, logs, etc. and shall provide the same interface methodology as the GUI. Systems that require different views or that require different means of interacting with objects such as schedules or logs will not be permitted.
3. **Security:** User identification and password security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented. Limitations of user access and control similar to that provided at the operator's terminal shall be assignable to each user.
4. **Editing Capabilities:** HTML editing by the operator shall be allowed, but not be required for proper operation.
5. **Graphics Storage:** Graphical screens shall be stored in the server. Systems that require graphics storage on the client machine are not acceptable.
6. **Real-Time Data Displays:** Values displayed on the web page shall update automatically without requiring a manual refresh of the web page.
7. **Links:** Graphical screens on the web browser client shall support hypertext links to other locations on the Internet or on Intranet sites through the Uniform Resource Locator (URL).

2.2 VALVE ACTUATORS

A. Manufacturers (Refer to Section 23 05 00):

1. Belimo, for air handling unit dampers and other system control dampers.
2. As manufactured by approved EMCS manufacturer, for control valves and air terminal unit dampers. Manufacturers who do not have valves and air terminal unit dampers labeled under the Manufacturer's name shall provide Belimo actuators.

B. High resolution type with positive feedback on valve or damper position, direct coupled type.

1. Spring-return operation to fail open or closed upon loss of signal or power when indicated on the drawings as normally open (NO) or normally closed (NC), respectively; constructed to maintain last position upon power failure when not specified to be either normally open or normally closed on the drawings.
2. Built-in overload protection to prevent damage to the actuator when the actuator or damper reaches its end position.
3. Designed for a minimum life of 60,000 cycles; selected for compatibility with associated equipment.
4. Damper actuators sized for 50 % safety factor with ample capacity to hold device at an intermediate position.
5. Valve actuators sized for torque required for valve close-off at maximum pump differential pressure. Valve actuators shall be factory installed on the valves with necessary hold off brackets and shields to protect the actuator from condensation and over-heating.
6. Actuator unit shall be submerged in oil and sealed in die cast case; UL listed; 3 year unlimited warranty.

2.3 WATER FLOW METER

A. Manufacturers (Refer to Section 23 05 00):

1. Onicon

- B. Insertion type turbine flow meter designed for "hot tap" installation on systems filled with fluid or, alternately, provide with an insertion meter installation kit complete with thread-o-let nipple and full port valve for installation on systems with no fluid in the system.
 - 1. F1200 Series Dual Turbine Flow Meters for pipe sizes 2 ½" and larger for irregular flow conditions caused by inadequate straight pipe runs.
- C. Pipe size and flow rate as indicated on the drawings.
- D. Materials-Chilled Water, Hot Water (to 280 degrees F), Condenser Water
 - 1. 316SS for heating water over 250 degrees F.
 - 2. 316 SS for non-metallic Pipe
- E. Materials-Make-up Water, Domestic Water, un-treated Non-Potable/Industrial Water Systems
 - 1. Meters furnished and installed by Division 22. Refer to Section 22 05 19.
- F. Performance and Options
 - 1. Wetted parts shall be bright tin plated brass or Type 316 stainless steel.
 - 2. Sensing method shall be impedance sensing, nonmagnetic and nonphotoelectric.
 - 3. Accuracy ± 2 % of actual reading from 0.4 to 20 FPS.
 - 4. 400 psi (maximum operating pressure).
 - 5. 200 degrees F (maximum continuous liquid temperature).
 - 6. Non-isolated analog output signals, 0 to 10 VDC and 20 mA, linear with flow. Binary (digital) dry contact output for bi-directional flow meter.
 - 7. 24 VDC power supply.
 - 8. Hot tap installation to include branch outlet tapping, close nipple, full port ball valve and hot tap adapter.
 - 9. Local display shall be LCD with BACnet interface. Display to suit application:
 - a. BTU applications: System 10 (LCD display that displays energy, flow and temperature data)
 - b. Flow applications: Series D-1200 or BD-1200 (bi directional flow)
 - 10. Provide with temperature sensors for monitor of energy in addition to flow when indicated on control drawings.

2.4 CONTROL VALVES

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. As manufactured by approved EMCS manufacturer, or approved by the Owner's Representative.
- B. 2-way or 3-way as indicated on the drawings
- C. Ball or butterfly valves of suitable construction for intended application in accordance with the manufacturers recommendations
- D. Throttling plugs and renewable composition seats
- E. Stainless steel ball and stems
- F. Suitable for close-off pressure differential equal to the total head of the respective circulating pump or system steam pressure
- G. Provided with manual positioning capability to allow manual positioning of valve in absence of control power
- H. Sized by the control contractor for a 4 psi maximum pressure drop
- I. Pressure rating: 125 PSI minimum working pressure.

2.5 CONTROLLERS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. As manufactured by approved EMCS manufacturer.
 - 2. Equipment Controllers

- a. Stand-Alone Operation: Integral processor, software, hardware, firmware, and memory sufficient to perform complete stand-alone control and operation of associated equipment.
 - b. Expansion: Controllers shall accommodate multiple I/O expansion modules for the possibility of future expansion.
 - c. Operator's Terminal Interface: All point data, algorithms and application software within a controller shall be custom programmable from the operator's terminal.
 - d. Self-Diagnostics: Each controller shall include self-diagnostics, which allow the controller to automatically notify the network controller of any malfunctions or alarm conditions that exceed desired parameters.
 - e. Operator's Interface: Each controller shall contain a port for connection of a portable computer. The entire system shall be accessible from this port.
3. Unitary Controllers
- a. Stand-Alone Operation: Upon loss of communication, each unitary controller shall execute its assigned control algorithm in a stand-alone mode.
 - b. Zone Temperature Sensor Compatibility: Unitary controllers shall support various types of zone temperature sensors including temperature sensor only, temperature sensor with setpoint adjustment, temperature sensor with local override switch, and temperature sensor with setpoint adjustment and local override switch.
 - c. For applications that require airflow measurement, the unitary controller shall include a precision built-in differential pressure transducer. The differential pressure transducer shall have a measurement range of 0 to 4,000 FPM and measurement accuracy of $\pm 5\%$ at 400 to 4,000 FPM. Controller shall include provisions for manual and automatic calibration of the differential pressure transducer. Automatic calibration shall occur whenever the system mode switches from occupied to unoccupied mode or vice versa.
 - d. VAV Applications: Unitary controller shall be provided with either a separate or integral direct-coupled electronic actuator. The actuator shall be of the on-off floating point control. The actuator assembly shall mount directly to the damper operating shaft. The actuator shall be electronically protected against overload.
 - 1) Provide serviceable air filter in tubing to VAV controller for airflow sensing technology that uses a flow through device that exposes instrumentation to room air.
 - e. Serviceability: Controller wiring terminal bars shall be of detachable type allowing quick serviceability of the electronic controller hardware without removal of the existing wiring.

2.6 VARIABLE FREQUENCY DRIVES (VFD'S)

- A. Furnished by the EMCS Contractor in Section 23 09 23 in accordance with Section 23 09 95.

2.7 GENERAL COMPONENTS

- A. Conduit: Conduit shall meet all requirements of the Latest Edition of the National Electrical Code and State Codes and Division 26.
- B. Contactors
 - 1. Single coil, electrically operated, mechanically held type
 - 2. Positive locking obtained without the use of hooks, latches or semi-permanent magnets
 - 3. Doubled break silver to silver type protected by arcing contact where necessary
 - 4. Number and rating of contacts selected for the intended application
 - 5. Operating and release times shall be 100 milliseconds or less
 - 6. Equipped with coil transient suppression devices to limit transients to 150 % of rated coil voltage
- C. Electronic Transmitters: Temperature sensing elements shall be thermistor or platinum RTD type as indicated below.
- D. Enclosures: Enclosures shall conform to the requirements of NEMA 250 for the types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damaged surfaces

shall be repaired and refinished using original type finish. Enclosures may be NEMA 1 when located in a clean dry indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean dry environment. Equipment installed outdoors shall be housed in a NEMA 4 enclosure. Penetrations shall be sealed to preclude entry of water using a silicone material. All control panels shall be UL listed for code compliance.

- E. Nameplates: Provide laminated plastic nameplates for all equipment and monitoring and control devices in accordance with the requirements of Section 23 05 53. Each nameplate shall identify the function, such as "mixed air controller" or "cold deck temperature sensor". Nameplates shall be in accordance with the requirements of Section 23 05 53.
- F. Power Conditioning
 - 1. Capacity shall match the equipment served
 - 2. Output 120 VAC, +6 to -8 % at 90 to 136 VAC input
 - 3. Maximum 2 % total harmonic wave form distortion
 - 4. 10 million to 1 common-mode noise attenuation (140dB minimum at 0.0)
 - 5. 57dB normal-mode noise attenuation for 10 Hz to 1 MHz
 - 6. Provide for all solid state equipment unless protection meeting these requirements is an integral part of the equipment.
- G. Relays
 - 1. General:
 - a. Rated for the intended application
 - b. Minimum of 2 sets of Form C contacts
 - c. Enclosed in a dust-proof enclosure
 - d. Rated for a minimum life-cycle of 1,000,000 operations
 - e. 20 milliseconds or less operating time
 - f. 10 milliseconds or less release time
 - g. Equipped with coil transient suppression devices to limit transients to 150 % of rated coil voltage
 - 2. Enclosed Relays (Relay-in-a-Box) RIB: SPDT enclosed relays with nipple mount for panel applications with LED status pilot light.
 - 3. DIN Socket Control Relays:
 - a. Plug-in type with dust cover
 - b. Contact rating, configuration, and coil voltage suitable for application
 - c. UL listed
 - 4. Time Delay Relays:
 - a. Solid state plug-in type with adjustable time delay
 - b. Delay shall be adjustable plus or minus 200 % from setpoint called for
 - c. Contact rating, configuration, and coil voltage suitable for application
 - d. NEMA 1 enclosure when not installed in local control panel
- H. Sensors
 - 1. General: Sensors and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.
 - 2. Provide wall boxes for sensing elements for conduit rough-in with extension rings if required due to finished surfaces on the walls.
 - 3. Outside Air Temperature Sensors: Resistor Temperature Detector (RTD) or thermistor; -20 °F to 180 °F temperature range, sun shield and weatherproof assembly for mounting to rigid conduit.
 - a. Install away from exhaust/relief vents. Preference should be given to locate as near as possible to the outside air intake for the air handling equipment, but keeping it out of direct sunlight or other reflective sources that would adversely affect its accuracy. When possible the sensor should be located on the northwest outside building wall.
 - 4. Immersion Temperature Sensors:
 - a. 10K ohm at 77 degrees F thermistor, ±0.5 degrees F accuracy.
 - b. Range as suitable for application.

- c. Provide stainless steel or brass thermowell for threaded mounting into pipe.
 - d. Thermal paste shall be used in all thermowells.
 - e. 4 or 8 inch insertion length depending upon pipe size and mounting configuration available (elbow, lateral or straight).
 - 5. Pressure Sensors:
 - a. Liquid Differential Pressure Sensors:
 - 1) Single pole, single throw switch
 - 2) Bellows type
 - 3) Adjustable range
 - 4) Suitable for intended application
- I. Switches
- 1. Bypass Switches:
 - a. Momentary contact type push button.
 - b. Installed in standard wall box with stainless steel cover.
 - 2. Current Switches (fan and pump status):
 - a. Self-powered.
 - b. Solid state.
 - c. Adjustable trip current; selected to match the current of the application and output requirements of the EMCS system.
 - d. UL listed.
 - e. Provide variable frequency drive rated current switches on motors with VFDs.
 - 3. End Switches:
 - a. Momentary type limit switches for monitoring motion of the damper at a prescribed arc of rotation.
 - b. Hermetically sealed mercury contacts that operate by way of a trip lever.
 - c. Mounted on the exterior of the duct so that the trip lever is aligned with the damper vane.
 - d. Mechanically adjustable in the switch case to set the proper lever action for tripping the mercury switch contacts.
 - e. SPDT contact arrangement exceeding the load requirements for both voltage and current.
 - 4. Flow Switches:
 - a. Water Service:
 - 1) Paddle type switch.
 - 2) Snap-acting with pilot duty rating (125 VA minimum).
 - 3) Adjustable sensitivity.
 - 4) NEMA 1 enclosure.
 - 5) UL listed.
 - 6) Alternatively, differential pressure type switches as specified herein.
 - 5. On/Off Switch:
 - a. Standard wall box type switch.
 - b. Single pole.
 - c. Illuminated switch with light activated when controlled device is on.
 - d. Stainless steel cover plate.
 - 6. Pressure-Electric Switches:
 - a. Metal or neoprene diaphragm actuated.
 - b. 1- or 2-stage switch action as required by application.
 - c. Open type when panel-mounted or enclosed type for remote installation.
 - d. Enclosed type shall be in a NEMA 1 enclosure unless noted otherwise.
 - 7. Water Differential Pressure Switches:
 - a. General purpose liquid flow switch.
 - b. SPDT snap-acting contacts.
 - c. Adjustable; neoprene diaphragm.
 - d. Dust-tight enclosure.
 - e. 150 PSIG maximum operating pressure.

- f. 250 degrees F maximum operating temperature.
- J. Sensor Wells
 - 1. Bronze or brass with NPT threads sized to match associated device.
- K. Transformers
 - 1. Current Transformers:
 - a. Current ratio as necessary for application.
 - b. Windings completely enclosed, except for terminals.
 - c. 1 % of full scale accuracy.
 - d. UL listed.
 - 2. Voltage Transformers:
 - a. 600 VAC rated.
 - b. Complete with built-in fuse protection.
 - c. Windings completely enclosed, except for terminals.
 - d. Suitable for ambient temperatures of 40 to 130 degrees F.
 - e. 0.5 % accuracy at 24 VAC.
- L. Transmitters
 - 1. Current Transmitters:
 - a. Self-powered combination split-core current transformer type with built-in rectifier and high-gain servo amplifier.
 - b. Unit range as necessary for application.
 - c. Internal zero and span adjustment.
 - d. 1 % of full scale accuracy.
 - e. UL listed.
 - 2. Voltage Transmitters:
 - a. Self-powered single loop type.
 - b. Internal zero and span adjustment.
 - c. 1 % of full scale accuracy.
 - d. UL listed.
- M. Wiring: All wiring shall be compliant to local building codes and the NEC and Division 26 of these specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate or if any discrepancies occur between the plans and the Contractor's work and the plans and the work of others, the Contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by this contractor at his expense.
- D. Review shop drawings for equipment being monitored by the EMCS system in the project submittal stage to ensure that equipment arrives with the proper control interface and communications protocol. Provide control integration drawings as previous indicated in part 1 submittal requirements of this section.

3.2 GENERAL

- A. Installation of temperature control system and equipment shall be complete under this section. Provide all required system components and wiring necessary to accomplish the specified sequences of operation as indicated on the drawings.
 - 1. Exception: Components specified to be factory furnished with a particular mechanical equipment item.
- B. All control devices installed in ductwork shall be positively anchored and attached to the ductwork by mechanical means. Duct access panels shall be provided for all such devices.
- C. It shall be the responsibility of this contractor to provide power for all devices requiring power. Coordinate with other trades to arrange for necessary power circuits. All control devices shall obtain power from dedicated control circuits. Provide control voltage transformers for low voltage control power.
- D. Wiring as used herein shall be construed as all wiring, conduits, hangers, etc., required for successful operation of the system. All wiring shall be in strict accordance with the latest edition of the National Electrical Code and local and state electrical code requirements and Division 26.
- E. Install equipment, piping, and wiring/raceways parallel to building lines wherever possible.

3.3 MOTOR CONTROLS

- A. Variable Frequency Drives (VFD's)
 - 1. VFD's furnished in Section 23 09 23 shall be installed in accordance with the requirements of Section 23 09 95.
 - 2. When VFD's are provided by others or as an integral part of the equipment, the control contractor shall attend the field start up and testing of the drives that are provided by others.
- B. For single phase motors, provide a 20 amp control relay in a box for EMCS start and stop in the power wiring circuit provided by Division 26.
- C. For three phase motors not furnished with VFD's, unless indicated otherwise, Division 26 provides a 120 volt control voltage transformer and contactor. Control contractors shall provide a 20 amp control relay in a box to intercept the control circuit.
- D. Coordinate locations of control relays and installation of work with Division 26.
- E. Safety relays for equipment shutdown are provided by 23 09 23. This includes high static, freeze stat, etc are furnished and installed by 23 09 23.
- F. Relays for shutdown for fire alarm conditions are provided by Division 28.

3.4 INSTALLATION

- A. Actuators: All actuators for dampers furnished with air handling units shall be furnished under this Section 23 09 23 and shipped to the air handling unit manufacturer by Section 23 09 23 contractor for factory mounting within the air handling units. Section 23 09 23 Contractor shall coordinate with the various air handling unit manufacturers as to the size and quantity of actuators required for proper control of the dampers.
- B. Airflow Measuring Station: Provide in sizes and locations shown on plans.
- C. Control Valves: Valves furnished under this section shall be installed under the Section associated with the piping system in which the valve is being installed. Coordinate with the appropriate piping contractor.
- D.
- E. Controllers
 - 1. General: Controllers shall be installed in convenient locations directly on or immediately adjacent to the controlled equipment. If locations are not shown on the drawings, verify location with owner's representative prior to installation.

2. Equipment Controllers: Provide a dedicated controller for each air handling unit or other HVAC system.
 - a. Exception: A single controller can serve multiple air handling units or systems if all points for each individual system are connected to the same system and required spare capacities are maintained as noted below. Points for a single system connected to multiple panels are unacceptable.
 - b. Spare Capacity: Provide a minimum of one AI/AO/DI and DO spare point at each air handler, boiler, and chiller controller. Provide a minimum of 25 % spare capacity on each communication trunk for future use.
3. Unitary Controllers
 - a. Unitary Controllers shall be provided as required. Unitary controllers serving mechanical equipment that is part of a larger system (e.g. air terminal unit controllers that are part of a VAV system) shall be connected to the EMCS through the equipment controller serving the associated system.
 - b. Air terminal unit controllers furnished under this section shall be shipped to the air terminal unit manufacturer by the EMCS contractor for factory mounting. Controllers and terminal units shall be factory calibrated to provide the maximum and minimum airflow values as indicated in the schedule. Final control connection, checkout, and calibration of factory-mounted controls shall be done at the site under this section. This shall include all terminal unit controllers.

F. General Components

1. Conduit: Provide as required in the wiring section in complete accordance with the applicable version of the NEC. Conduit terminations shall be free from burrs with a strain relief fitting provided.
2. Nameplates: Provide system and component labeling in accordance with the requirements of Section 23 05 53. All control components except room temperature sensors shall be equipped with nameplates to identify each control component. Contractor shall submit proposed labeling list prior to installation of labels.
3. Sensors
 - a. General:
 - 1) Mount sensors rigidly and adequately for the environment within which the sensor operates.
 - 2) All wires attached to sensors shall be air-sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
 - 3) Outside Air Temperature Sensors: Install on a north wall complete with sun shield. Verify location with the Engineer prior to installation.
 - 4) Pressure Sensors: The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
4. Thermometer Wells: All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
5. Transmitters
 - a. Provide for all temperature and pressure sensing
 - b. Serpentine transmitter and controller cap tube averaging elements in mixed air and across coil face to prevent possibility of sensing stratified air
 - c. Provide access panels for temperature transmitters located in return/exhaust ductwork
6. Wiring
 - a. Wiring inside control cabinets shall be dressed neatly and tied with Thomas and Betts wire ties. Plastic tooth wire ties are not acceptable.
 - b. All field wiring entering control cabinets shall be labeled with Thomas and Betts self-laminating wire markers or appropriate alphanumeric labels corresponding to termination shown on the control drawings. Colored phase tape shall not be used.
 - c. Wiring routed from equipment shall be in a manner as to avoid injury to the wiring.
 - d. "Across-the hinge" wiring shall be dressed to avoid strain and abrasion. Provide spiral wrap suitable to this application.

- e. Install instrumentation grounding as necessary to preclude ground loops and noise from adversely affecting equipment operations.
- f. All wiring shall be enclosed in conduit.
- g. All wiring requirements noted above apply to communications wiring. The following requirements are intended to be supplemental to those requirements.
 - 1) Communication wiring shall not be installed in raceway and enclosures containing Class 1 or other Class 2 wiring.
 - 2) Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.
 - 3) Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
 - 4) Provide a lightning arrestor between the lines and ground wherever a cable enters or exits a building.
 - 5) Communication wiring shall be installed in continuous lengths. Spliced wires are not acceptable.
 - 6) Grounding of coaxial cable shall be in accordance with NEC Regulations Article on Communications Circuits, Cable and Protector Grounding.
- 7. Fiber Optic Cabling
 - a. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
 - b. All cabling and associated components shall be installed in accordance with manufacturer's instructions. Minimum cable unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.5 START-UP, CALIBRATION, TESTING AND DEMONSTRATION

- A. Start-up and check-out
 - 1. Verify that all circuits, controls and devices are properly installed.
 - 2. Check connectivity of all control points between field devices and controllers. Check and confirm all device addresses and control points.
 - 3. Verify that all dampers and control valves operate in the correct direction.
 - 4. Energize the controlled equipment and test for proper operation. Make all necessary adjustments, remove and replace any malfunctioning devices and retest.
- B. Calibration and Adjusting
 - 1. Calibrate all sensors and devices.
 - 2. Submit calibration sheets to the Owner's Representative.
 - 3. Make 3-point calibration test for both linearity and accuracy for each analog device.
 - 4. Calibrate devices according to manufacturer's directions.
 - 5. Adjust flow, pressure and temperature switches.
 - 6. Stroke and adjust control valves and dampers.
 - 7. Adjust all initial temperature setpoints.
- C. Testing
 - 1. The completed control system shall be adjusted and tested under operating conditions by a qualified technician in the employ of the EMCS Contractor.
 - 2. Before commencing the testing, the technician shall prepare an Owner approved, itemized log for the full range of control functions for each system. The log shall be initialed by the test engineer as each test is performed.
 - 3. When the testing is completed, the test log and a letter of certification stating that all control functions of the system have been checked and are in satisfactory operating order and in compliance with the contract documents shall be given to the Owner.
- D. Programming
 - 1. Coordinate occupied/unoccupied schedule for each unit and zone with the Owner and provide project specific schedules in the programming. Schedules shall include occupied/unoccupied modes with night setback control.

2. Provide staggered start-up of equipment after power outage or at morning warm-up to prevent high amp draw on building electrical service.
 3. Equipment shall return to a failsafe unoccupied mode after emergency shutdown (freeze stat, fire alarm etc) with outside air dampers close and return dampers open.
 - 4.
 5. For energy and flow metering provided on the project, provide trend logs that indicate total monthly flow/energy and peak monthly demand. The extent of devices capable of power monitoring is indicated on the control diagrams. Device may include:
 - a. VFD's: Monitor of fan energy through VFD interface
 - b. Water flows from water flow meters
- E. Operator's Terminal
1. All points of control shall be available at the operators terminal (visual and hard copy printout).
 2. Alarms shall register for equipment status or conditions out of setpoint range.
- F. Demonstration
1. The complete and fully operational control system shall demonstrated to the designated Owner's personnel and project engineer upon completion of successful start-up and testing. Demonstration shall be an overview of the entire functionality of the system including the operator's terminal, the web browser interface, the graphical user interface, remote control point adjustment, scheduling procedures, overrides, alarms, unitary and terminal unit control.
 2. Demonstration of the system shall occur in order to verify overall compliance with the above start-up and testing.
 3. Demonstration shall be prior to, and in addition to, the required operator training.

3.6 SERVICE AND TROUBLE SHOOTING

- A. Perform the regularly scheduled maintenance service visits as required by Part 1 of these specifications.
- B. Provide warranty service and system troubleshooting as needed during the project warranty period.

3.7 SYSTEM SCHEDULING

- A. During initial set-up and programming of the control system, the EMCS Contractor shall work closely with the Owner's staff to develop and program equipment utilization schedules.
1. Equipment utilization schedules shall allow the Owner to operate groups of equipment in occupied mode based on the use of the building through selection of the appropriate utilization schedule at the Operator's workstation. Any piece of equipment shall have the capability of belonging to more than one utilization schedule.
 2. The type and expected duration of the building activities shall dictate which mechanical systems and HVAC equipment must be operational, as well as the appropriate occupied setpoints.

3.8 96-HOUR TEST RUN

- A. The 96-hour test run shall be made when all field equipment is installed and the system is calibrated and running, and when all other building systems (including drywall, windows, doors, etc.) are complete. This period is intended to demonstrate the operation of the complete building.
- B. The 96-hour test run shall include performance of all associated software and hardware operations called for in these specifications. The test shall be for a duration of 96 continuous hours with no Contractor maintenance required. The pre-balance conference shall not be scheduled until this test has been completed satisfactorily (i.e. run without errors or alarms for a continuous 96-hour period). Notify Owner's Representative prior to beginning the 96-hour run test.

3.9 COMMISSIONING REQUIREMENTS

- A. Refer to section 23 05 00 and division 1.

PART 4 - SEQUENCE OF OPERATIONS

- 4.1 SEE CONTROL DIAGRAMS ON DRAWINGS FOR REQUIRED SEQUENCE OF OPERATION.**

END OF SECTION

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SECTION 230995
VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Variable Frequency Drives (VFD) for Mechanical work. Variable Frequency Drives to be furnished by Section 23 09 23 in accordance with this section unless specified or scheduled to be factory furnished with the particular mechanical equipment item.

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
- C. Division 26

1.3 SUBMITTALS

- A. Submit in accordance with Section 23 05 00.
- B. Submit statement guaranteeing compatibility of submitted motors with submitted variable frequency drives. Coordinate with the motor manufacturer to guarantee that the motor supplied are “Inverter Duty” class motors and will operate properly with the submitted variable frequency drives without objectionable motor noise, heat, or loss of efficiency.
- C. Submit product manuals and drawings which include wiring diagrams, dimensions, front view and catalog information indicating complete electrical and mechanical characteristics.
- D. Submit an application specific programming plan showing the parameters and options selected for each drive.
- E. Submit qualifications of agent who will perform start-up and testing.
- F. Submit a recommended spare parts list.
- G. Submit a troubleshooting, repair and maintenance manual.
- H. Submit calculations showing the effect of the variable frequency drives on the building system.
- I. Submit service manuals including interboard wiring, detailed troubleshooting procedures, and spare parts list and suppliers.

1.4 REGULATIONS

- A. The drive shall be built to applicable NEMA standards for use as a component to meet NEC requirements.
- B. Drive is to be listed by Underwriter’s Laboratories (UL).
- C. IEEE 519: Total harmonic distortion, 5 % maximum (Complying with IEEE 519, without external isolation transformers, line reactors or filters)
- D. IEEE 587: Surge Protection
- E. FCC, Part 15, Subpart J: EMI and RFI radiation
- F. NFPA 70 - National Electrical Code

1.5 QUALITY ASSURANCE

- A. All drives shall be burned-in for a minimum of seventy-two (72) hours, cycling load to simulate no load/full load and exercise drive power requirements.

- B. The complete drive shall be functionally tested with a motor before shipment to assure proper operation per specification.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES (FULLY FEATURED)

- A. Manufacturers (refer to 23 05 00):
 - 1. ABB ACH550
- B. Application/Use: All drives except for applications that allow microdrives
- C. The drive shall be designed to provide ease of maintenance and shall be modularly constructed. Printed circuit boards shall have plug-in connections and be easily removed from the drive. Power components shall be readily accessible and have "fast-on" or screw terminal connections for easy removal.
 - 1. Unless otherwise specified, the drive shall be a NEMA Type 1 enclosure.
 - 2. The drive shall consist of the following major components:
 - a. Input rectifier section to supply fixed DC bus voltage
 - b. Phase-to-phase and phase-to-ground MOV protection
 - c. Smoothing reactor for the DC bus
 - d. DC bus capacitors
 - e. Sine weighted pulse width modulated (PWM) inverter section consisting of Insulated Gate Bipolar Transistors (IGBT's)
 - f. Separate terminal blocks for control and power wiring
 - g. Input line reactors
 - h. Integral motor rated circuit and breaker disconnect and handle operation.
 - i. 5 % input line impedance.
 - 3. Bypass contactors:
 - a. Bypass contactors shall be provided when specifically scheduled on the drawings.
 - b. Bypass contactor shall provide a means to manually switch a single motor from drive control to line power operation. Provide a full voltage, non-reversing contactor for line operation. Bypass contactor function shall electrically isolate the drive line and load connections as well as provide the bypass path.
 - c. In addition to the electronic overload inherent to the drive, furnish an external overcurrent protective device (thermal magnetic type). This device would protect for overloads in the bypass, hand and auto mode.
 - d. Bypass contactor/drive combination enclosure shall include: hinged front door, top or bottom conduit entry, ¼ turn door locking mechanism.
 - e. Shall conform to all applicable provisions specified in Division 26 such as for overload protection and lockable disconnects. Power factor correction capacitors are not required.
 - 4. The following devices shall be operable with the enclosure door closed:
 - a. Bypass-Hand-Off-Auto selector switch
 - b. Run/Stop Indication
 - c. Manual speed control
 - d. Digital display and keyboard
 - e. Resetting of the external overcurrent protective device
 - 5. Enclosure and components shall have a minimum short circuit interrupting rating of 14,000 amps. Short circuit and overcurrent protective devices shall be selected to coordinate with other in-line devices according to Division 26. Digital display panel and keyboard for programming, operation, and fault codes diagnostic information shall be provided. No adjustments by potentiometers other than manual speed control is acceptable. All drive set-up operations and adjustments shall be digital and stored in a nonvolatile memory (EEPROM).
- D. Operating Conditions
 - 1. The drive shall be suitable for use in normal indoor non-hazardous environments subject to the following conditions unless otherwise indicated:

- a. Ambient temperature range of 0 to 40 °C
 - b. Humidity range from 5 to 95 %, non-condensing
 - c. Fan-assisted cooling shall be used where required to dissipate heat. The fan shall be installed in such a manner as not to degrade the enclosure rating.
- E. Input Power
1. Unless otherwise specified, the drive shall accept 460VAC, 3-phase, 60 Hz.
 2. Accept input line voltages of 400 to 500VAC ± 10 % and line frequency of 48 to 63 Hz.
 3. Drive shall be equipped with an automatic extended Power Loss Ride-through circuit which will utilize the inertia of the load to keep the drive powered. Minimum Power Loss Ride Through shall be one cycle based on full load and no inertia.
 4. The drive input circuitry shall not generate line notches or large voltage transients on the incoming line. Provide protection through EMI/RFI filters.
 5. The drive shall present a displacement power factor of 0.95 or better to the AC line at any speed or load.
 6. The drive control efficiency at rated load and frequency shall be 98 % or better to the AC line at any speed or load.
 7. The drive shall have input transient protection and shall not be sensitive to notching on the incoming line.
 8. Shall be capable of automatic restart after overvoltage, overcurrent, undervoltage, or loss of input signal trip. Number of restart attempts and timing shall be programmable.
- F. Output Power
1. The drive shall produce a (sine weighted PWM) three phase output for the load.
 2. Unless otherwise specified, the standard drive output frequency shall be adjustable from 0 to 120 % of base speed.
 3. Unless otherwise specified, the drive output voltage shall be adjustable from 0 to 460 VAC, reaching 460 V at 60 Hz.
 4. Variable torque drives shall produce a reduced volts-per-hertz (V/Hz) ratio in the 60 Hz range and below.
 5. Constant torque drives shall produce a constant volts-per-hertz (V/Hz) ratio in the 60 Hz range and below.
 6. Unless otherwise specified, the drive shall supply a constant 460 V output when operating above 60 Hz.
 7. The volts-per-hertz output of the drive shall not be affected or require readjustment when other drive adjustments (such as maximum speed) are changed.
 8. Selectable constant V/Hz ratio or configurative V/Hz ratio. The drive shall have selectable pre-programmed V/Hz ratios and the capability of programming a custom V/Hz pattern.
 9. As standard, the drive will have the ability to produce a linear or squared V/Hz curve.
 10. When subject to the range of ambient conditions stated above, the drive shall be capable of maintaining 110 % of rated output current continuously.
 11. When subject to the range of ambient conditions stated above, the drives shall be capable of delivering for up to one minute, the following:
 - a. 110 % of rated output current for variable torque drives.
 - b. 150 % of rated output current for constant torque drives.
 12. The drive shall have field adjustable PWM carrier frequency to minimize audible motor noise. The carrier frequency shall be adjustable from approximately 1 KHz to at least 3 KHz.
 13. The drive shall be capable of operating the output open circuited with no fault or damage.
 14. The drive shall be capable of delivering 150 % starting torque in starting torque application and 110 % in variable torque applications.
- G. Control Features:
1. Bypass-Hand-Off-Auto selector switch functions for bypass contactor/drive applications:
 - a. Bypass selected: The bypass contactor starts the motor.
 - b. Hand selected: the speed is controlled from the local operator control panel. The remote 0 to 10VDC signal shall be isolated and have no control in this position.
 - c. Off selected: the drive cannot be started.

- d. Auto selected: the drive shall be started and stopped via a remote dry contact (24 VDC or less). The speed shall be in proportion to a remote 0 to 10 VDC control signal.
 2. Unless otherwise specified, the drive shall produce an output frequency proportional to the speed reference without external feedback.
 3. For all analog speed commands, the drive shall maintain set frequency to within 0.01 Hz during power line fluctuations or changes in ambient temperatures.
 4. Within the drive rating, the drive shall maintain set frequency and not require readjustment due to changes in load.
 5. The drive shall have a foldback current limiting circuit. During acceleration, the circuit shall automatically reduce the acceleration rate to a slower rate should the load inertia cause excessive currents.
 6. The drive shall have a selectable deceleration voltage limiting circuit. The circuit shall extend the set deceleration ramp should the bus voltage approach high limits due to regeneration.
 7. The drive shall have incrementally adjustable IR compensation boost. A selectable range for offsetting motor losses at low frequency operation shall be used to optimize motor torque for starting high inertia and high friction loads.
 8. Drive operation shall be fully digital with microprocessor control of frequency, voltage and current.
 9. The drive shall be capable of starting with the load regenerating voltage back on the drive bus.
 10. The controls (including bypass-hand-off-auto) shall have the capability of being overridden by the opening of a normally closed dry contact, supplied and operated by the building fire alarm system.
- H. Speed Control
1. The drive shall contain an independent parameter which will provide an adjustable minimum speed setting from 0 to 70 Hz.
 2. The drive shall contain an independent parameter which will provide an adjustable maximum speed setting from 40 to 70 Hz.
 3. The drive shall accept an analog input reference of 0 to 10 VDC, or from a potentiometer. The 0 to 10 VDC option shall be the standard reference unless otherwise indicated.
 4. The drive shall provide a "percentage of load" analog output signal (e.g. 0 to 10 VDC) for remote monitoring. Output shall be compatible with Mechanical requirements.
 5. Selectable coast or controlled ramp stop or DC braking. Selectable stopping modes of coast, ramp to stop or DC brake to stop shall be available.
 6. Three adjustable skip frequencies shall be provided to minimize equipment resonances.
- I. Drive Controls
1. The drive start/stop commands shall have the capability of operating from TTL, 24 VDC, 115 VAC optional interface boards. The 24 VDC option shall be the standard unless otherwise indicated.
 2. The drive shall accept contact closure (2-wire control) or separate start and stop push buttons (3-wire control).
 3. The drive inverter shall have capability to be enabled without the need for a start signal, after initial drive power-up.
 4. The drive shall have selectable auto restart after a power loss or other pre-selected fault condition. When applied to a spinning motor, the drive shall synchronize to the motor's speed and smoothly accelerate the motor back to the setpoint speed without resetting, recycling or re-enabling the controls. Four (4) retry attempts shall not invalidate the manufacturer's warranty.
 5. Internal lockout of panel controls shall be provided to prevent the changing of system parameters. Viewing capability shall not be affected.
 6. Drive shall accept a normally closed dry contact signal from an external source, which, when opened will stop the drive in bypass, hand, or auto.
- J. Protection
1. Protection is defined as the normal shutdown without any drive, motor or equipment damage.

2. The drive shall be capable of monitoring, annunciating and shutting down the drive for the following conditions:
 - a. MOPC
 - 1) The drive shall have an adjustable momentary overload protection circuit (MOPC) adjustable from 50 to 115 % of drive rating for variable torque drives and from 50 to 150 % of drive rating for constant torque drives.
 - b. Motor Overload Protection
 - 1) The drive shall provide programmable electronic motor overload protection in compliance with the NEC and tested in accordance with UL Standard 991.
 - 2) The overload protection shall be adjustable from 50 to 110 % of the drive full load current rating.
 - c. Overvoltage/Undervoltage Protection
 - 1) Outside ± 10 % of rated input voltage
 - d. Phase Protection
 - 1) The drive shall have protection against (and indicate), a phase-to-phase short in the output load, or a short circuit in a phase of the output module.
 - e. Heat Sink Temperature
 - 1) The drive shall monitor the temperature of the heat sink. If the heat sink temperature exceeds approximately 212 °F, the drive shall shut down and annunciate the condition on the digital display panel.
 - f. Ground Fault Detection
 - g. Bus Charged Indication
 - 1) When power is applied to the drive and hazardous potentials exist on the DC bus, the drive shall provide a visual indication at the front of the drive. These indications shall remain lit until power is removed from the drive and the DC bus discharges to potential of 40 VDC or less.
 - h. Bus Discharge Protection
 - 1) The drive shall contain circuits that will discharge the DC bus to below 40 VDC within 60 seconds after input power is removed from the drive. (Note: 40 V is the current NFPA standard).
 - i. Input fusing
 - 1) The drive shall have input line fuses as a standard feature in the drive enclosures.
 - K. Drive Diagnostics
 1. The drive shall execute, on initial power-up, a self-diagnostic check. The integral programming display panel shall provide first fault indication of the drive protection functions. Fault indication shall be retained if input power is lost. Fault codes shall provide direction as to board level and input/output level to aid in trouble shooting.
 - L. Serial Communications
 1. Provide capability to Interface with the EMCS System in Section 23 09 23 through one of the trace three protocols selected by the EMCS Contractor.
 - a. The drive shall be capable of communication with the Landis & Staefa System 600 Control System utilizing the Landis & Staefa Protocol/1 Local Area Network, without use of additional circuit boards or third party interfaces.
 - b. BacNet Protocol
 - c. Lonworks Protocol
 2. Provide with (2) programmable analog outputs, (3) programmable relay outputs.
- ## 2.2 SERVICE
1. Manufacturer shall maintain a service center or service representative within 150 miles of the job site. This center must normally provide the following services:
 - a. Factory coordinated start-up service.
 - b. Perform service calls and providing replacement parts within twenty-four (24) hours
 - c. Provide service contracts.
 - d. Training of customers in operation and basic troubleshooting.
 - e. Maintaining a stock of frequently replaceable parts at a local warehouse.

PART 3 - EXECUTION

3.1 EXECUTION

- A. Sizing:
 - 1. The drives shall be sized as required by the scheduled motors. See Mechanical and the Mechanical Drawing Schedules for motor information. The drive shall be sized for the specified motor size plus a 10 % service factor.
 - 2. The drives shall be sized to continually operate the motors at 110 % of full load current or greater.
 - 3. Either a variable or constant torque drive shall be selected based on the application and shall be provided as specified for each application.
- B. Installation and Field Wiring:
 - 1. Mounting and power wiring and power terminations shall be provided by Division 26.
 - 2. Control wiring and control terminations shall be provided by Section 23 09 23.
 - 3. The variable frequency drives on air distribution equipment shall be installed out of the airstream so that setup and testing can be accomplished without disrupting system pressures and airflows. In some applications where is not practical, such as packaged equipment, the drives shall be furnished with a remote mounting keypad which shall be installed in the controls section of the cabinet or other suitable enclosure on the side of the unit.
- C. Field Start Up and Testing
 - 1. The start-up and testing is to be provided at the installation site by the manufacturer or other agent deemed acceptable by the Owner's Representative.
 - 2. Verify all installation connections and controls.
 - 3. Field adjust all safety controls.
 - 4. Field adjust all drive parameters (including acceleration and deceleration ramps and volts-to-hertz ratio for smooth operation).
 - 5. All mechanical components shall be adjusted for proper alignment.
 - 6. Demonstrate satisfactory operation of drive including line reactors, filters, and the bypass contactor under full load rpm.
 - 7. Submit start-up and test report in accordance with Section 23 05 00.
- D. Training
 - 1. Provide on-site operation and maintenance training by manufacturer or other agent deemed acceptable by the Owner's Representative for two (2) identical four (4) hour sessions. Coordinate training times with the Owner's Representative.
 - 2. At the sessions, include troubleshooting, repair, and maintenance manuals for six (6) maintenance personnel. This is in addition to copies furnished in the Operation and Maintenance Manuals.

END OF SECTION

SECTION 232113
HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Access Doors
- B. Chilled Water, Condenser Water, Equipment Drain and Overflow Piping, Above Grade
- C. Unions, Flanges and Couplings

1.2 RELATED SECTIONS

- A. Division 3 – Concrete
- B. Division 8 – Access Doors
- C. Division 9 – Painting
- D. Section 23 05 00 – Common Work Results for HVAC
- E. Section 23 05 17 – Sleeves and Sleeve Seals for HVAC
- F. Section 23 05 19 – Meters and Gauges for HVAC Piping
- G. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- H. Section 23 05 48 – Vibration Controls for HVAC
- I. Section 23 05 49 – Seismic Controls for HVAC
- J. Section 23 05 53 – Identification for HVAC Piping and Equipment
- K. Section 23 07 00 – HVAC Insulation
- L. Section 23 21 16 – Hydronic Piping Specialties
- M. Section 23 25 00 – HVAC Water Treatment

1.3 REFERENCES

- A. General
 - 1. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
 - 2. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300
 - 3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
 - 4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - 5. ASME B31.9 - Building Services Piping
 - 6. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
 - 7. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
 - 8. ASTM B32 - Solder Metal
 - 9. AWS D1.1 - Structural Welding Code
- B. PVC Piping
 - 1. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 - 2. ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
 - 3. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

4. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
 5. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 6. ASTM F437 - Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
 7. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 8. ASTM F679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
 9. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches Through 12 inches for Water Distribution
- C. Jackets and Fitting Covers
1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.4 GENERAL

- A. All materials shall be compatible with ethylene and propylene glycol.

1.5 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- B. Pre-Insulated Direct Buried Piping Systems
- C. The manufacturer of the pre-insulated direct piping systems shall provide engineered layout drawings with the submittals including installation details and provisions for expansion and contraction.
- D. Installation Instructions: Submit manufacturers installation instructions for buried piping systems with the product data. Installation instructions shall include:
1. Cleaning and flushing
 2. Pressure testing
 3. Field joint installation details
 4. Backfill and compaction

1.6 QUALITY ASSURANCE

- A. Welding Materials and Procedures: Conform to ASME SEC IX and applicable state regulations.
- B. Welders Certification: In accordance with ASME SEC IX.
- C. Pre-insulated direct buried pipe shall be fully engineered system. Straight lengths, tees, anchors and end seals shall all be pre-engineered components. Thermal stress and displacement, heat loss/gain, soil loading calculations and layout drawings shall be provided.

1.7 PROJECT RECORD DOCUMENTS (REFER TO SECTION 23 05 00)

- A. Record actual locations of piping.

1.8 QUALIFICATIONS

- A. Welders: Certified in accordance with ASME SEC 9 and AWS D1.1.

1.9 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state and local labor regulations.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 23 05 00.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.11 TESTING (REFER TO SECTION 23 05 00)

- A. Test in the presence of the Owner's Representative.
- B. Systems:
 - 1. Chilled Water
 - 2. Condenser Water
- C. Above Grade Piping Test
 - 1. Piping systems shall be tested with a hydrostatic test of not less than 125 psig. Due care shall be taken that equipment with a maximum working pressure which is less than the required test is removed from the line during the test. After the test is complete, the equipment shall be reinstalled and a test of the maximum working pressure of the equipment put on the connections to the respective equipment.
 - 2. Test piping prior to insulating.
- D. Below Grade Piping Test
 - 1. Buried piping shall be hydrostatically tested in accordance with the manufacturer's instructions.
 - 2. Tests shall be similar to above grade piping test except test pressures shall be lowered to the maximum working pressure of the pipe.
 - 3. Test piping prior to covering.
- E. Submit certificate of tests to the Owner's Representative for review.
- F. Include certificate of tests in the Operation and Maintenance manual.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

- A. Materials shall be in accordance with Division 8.

2.2 EQUIPMENT DRAIN AND OVERFLOW DRAIN (ABOVE AND BELOW GRADE)

- A. Provide in accordance with 22 10 00.

2.3 CHILLED WATER AND CONDENSER WATER (ABOVE GRADE)

- A. Up to and including 2 inches:
 - 1. Copper tubing: ASTM B88; type L; hard drawn; fittings: solder wrought copper fittings, ASME B16.22; ASTM B32, 95-5 tin-antimony or tin and silver solder with melting range of 430 to 535 °F, lead-free. Fittings shall be full nominal diameter inside and long radius.
 - 2. Steel: ASTM A53; schedule 40 black; ASME B16.3 malleable iron fittings; 125 psi; threaded joints
- B. Pipe over 2 inches:
 - 1. ASTM A53; schedule 40 black; ASTM A234 forged steel welding type fittings
 - 2. Copper pipe; ASTM B88; type L; hard drawn; soldered; ASME B16.22, Solder wrought copper fittings; ASTM B32, 95-5 tin-antimony, or tin and silver solder joints with melting range of 430 to 535 °F, lead free.
 - 3. Groove locked couplings: In lieu of welded flanged or soldered joints noted above, groove locked couplings as specified below may be used IN ACCESSIBLE AREAS ONLY for piping

systems which do not exceed the design parameters of the respective gasket. Piping enclosed in inaccessible chases and shafts, above inaccessible ceilings or otherwise inaccessible shall have welded or soldered joints as specified above.

2.4 CONDENSER WATER (BELOW GRADE)

- A. High Density Polyethylene (HDPE):
 - 1. ASTM-3350, SDR-1
 - 2. Joints: Butt fusion welded below grade; flanged above grade for transition.
 - 3. Above grade HDPE piping and flange connection shall be protected with aluminum jacket and fitting covers:
 - a. Manufacturers (Refer to Section 23 05 00):
 - 1) Childers
 - 2) Pabco
 - b. ASTM B209
 - c. Jacket: Thickness: 0.020 inch sheet; finish: embossed; joining: Longitudinal slip joints and 2 inch laps.
 - d. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - e. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.5 CHEMICAL WATER TREATMENT INJECTION PIPING

- A. Schedule 80 PVC Pipe: ASTM D1785
 - 1. Fittings: PVC
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
 - 3. Hollow core and cellular core pipe and fittings are not allowed.
 - 4. Above grade PVC piping shall be protected with aluminum jacket and fitting covers:
 - a. Manufacturers (Refer to Section 23 05 00):
 - 1) Childers
 - 2) Pabco
 - b. ASTM B209
 - c. Jacket: Thickness: 0.020 inch sheet; finish: embossed; joining: Longitudinal slip joints and 2 inch laps.
 - d. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - e. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.6 PIPE HANGERS AND SUPPORTS

- A. Materials shall in accordance with Section 23 05 29.

2.7 UNIONS, FLANGES, AND COUPLINGS

- A. Unions for Pipe 2 inches and under: 150 psig threaded malleable for ferrous piping; bronze with soldered joints for copper pipe.
- B. Flanges for Pipe over 2 inches: 150 psig forged steel slip-on for ferrous piping; bronze for copper piping; gaskets to suit application for system temperature, pressure, and fluid type.
- C. Grooved and Shouldered Pipe End Couplings (Steel):
 - 1. Manufacturers (Refer to Section 23 05 00):
 - a. Victaulic
 - b. Gruv-Lok
 - 2. Sealing Gasket: Grade E, EPDM, 150 psi, -30 to 230 °F
 - 3. Couplings:
 - a. Victaulic Style 75, 77, 72, and 750 for all pipe joint connections requiring movement/expansion/contraction/deflection (including heating water system)
 - b. Victaulic Style 07 "Zero Flex" rigid couplings for all pipe joint connections not requiring joint flexibility

- 4. Accessories: Steel bolts, nuts, and washers
- D. Grooved and Shouldered Pipe End Couplings (Copper):
 - 1. Manufacturers (Refer to Section 23 05 00):
 - a. Victaulic
 - 2. Sealing Gasket: Grade E, EPDM, 150 psi, -30 to 230 °F
 - 3. Couplings:
 - a. Couplings for copper tubing shall be Style 606 "No-Sweat" and shall consist of a cast ductile iron housing conforming to ASTM A536 with a copper alkyd enamel paint coating.
 - b. Victaulic Flanged Connections shall be Style 641 "No Sweat" Vic Flange Adaptors. They shall engage directly into roll grooved copper tube and fittings and shall bolt directly to ANSI Class 125 cast iron and Class 150 steel flanged components.
 - c. Victaulic Fittings shall be Victaulic full flow copper fittings with grooves designed to accept Victaulic "No Sweat" grooved end couplings or flanges. Fittings for 2½ to 4 inch shall be copper per ASTM B75 and ASTM B584 for 5 to 6 inch sizes.
 - 4. Accessories: Steel bolts, nuts, and washers
- E. Dielectric Connections: Union with galvanized or plated steel threaded end; copper solder end; water impervious isolation barrier.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00.
- F. Provide temporary piping connections for use in cleaning and flushing provided in Section 23 25 00.

3.2 INSTALLATION – GENERAL

- A. Provide pipe as indicated on the drawings.
- B. Install in accordance with manufacturer's instructions and ASME B31.9.
- C. Install aluminum jackets located outdoors with seams located on bottom side of horizontal piping. Apply sealing compound and closures to make weathertight.
- D. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- E. Provide piping and all required offsets and fittings in order to coordinate with other trades, minimize structural interferences, conserve space, and maintain headroom. Refer to Section 23 05 00 – Common Work Results for HVAC, paragraph Locations.
- F. Group piping whenever practical at common elevations.
- G. Sleeve pipe passing through partitions, walls and floors. (Refer to Section 23 05 17)
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- I. Provide supports, hangers (and spacing), insulation, shields, sleeves, escutcheons, and inserts in accordance with Section 23 05 29.
- J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 00.

- K. Provide access doors where fittings are not exposed unless indicated to be provided under other divisions. Access doors shall comply with Division 8.
- L. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- N. Prepare unfinished supports and devices for finish painting in accordance with Section 23 05 53.
- O. Install control valves, sensor wells, flow meters, and any other hydronic devices provided under Section 23 09 23 in accordance with the manufacturer's recommendations. Provide piping to hydronic differential pressure sensors provided under Section 23 09 23. Control devices are sized in 23 09 23. Provide adaptors from valve size to pipe size in the piping immediately at the valve connection points.
- P. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- Q. Use grooved mechanical couplings and fasteners only in accessible locations. Inaccessible locations shall be defined as spaces above inaccessible gypsum ceilings and inaccessible chases. Spaces above t-bar "lay-in" ceilings shall be considered accessible for the purposes of this section.
- R. Flanges / Unions:
 - 1. Steel Pipe:
 - a. Threaded pipe, 2 inches smaller: Install unions downstream of each valve with screwed joint upstream
 - b. Welded pipe, 2 ½ inches and larger: Flanged connections both sides of valve
 - c. Use unions at final connection to each piece of equipment or apparatus having a threaded pipe connection.
 - d. Use flanges at final connection to each piece of equipment or apparatus having a flanged pipe connection.
 - 2. Copper Pipe:
 - a. Threaded pipe: Install union down stream of each valve with screwed joint up stream. Use brass male adapters each side of valve.
 - b. Soldered pipe: No unions required either side of valve.
 - c. Use unions at final connection to each piece of equipment or apparatus having a threaded pipe connection.
 - d. Use flanges at final connection to each piece of equipment or apparatus having a flanged pipe connection.
 - 3. Notes to above: Temperature control valves shall have unions and/or flanges at each port. Valves with screwed connections that cannot be rotated shall have unions on each side of valve. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- S. Use non-conducting dielectric connections whenever jointing dissimilar metals.
- T. Buried condenser water piping (Fusion Welded):
 - 1. All field joints shall be thermal butt-fusion welded. Weld pressures, temperatures and time shall be in accordance with the manufacturer's recommendations. Field joints may be made either inside the trench or on top of the trench. For joints made on top of the trench, the piping may be rolled or dropped in place inside the trench.
 - 2. System does not require thrust blocks but provide restraint of the piping system where the pipe penetrates the building foundation wall and where the pipe drops below grade near the cooling tower.
 - 3. Pipe exposed above grade shall be jacketed to provide UV protection.

- U. Buried thermoplastic piping shall be installed following procedures outlined in 230500 and per ASTM D 2774 and ASTM F 1668.

END OF SECTION

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SECTION 232116
HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Air separators
- B. Air vents
- C. Balancing cocks
- D. Expansion tanks
- E. Flow control balancing valves (manual)
- F. Reducing valves
- G. Relief valves
- H. Strainers
- I. Venturis

1.2 RELATED SECTIONS

- A. Section 22 05 04 – Plumbing Specialties
- B. Section 23 05 00 – Common Work Results for HVAC
- C. Section 23 05 23 – General Duty Valves for HVAC Piping
- D. Section 23 21 13 – Hydronic Piping
- E. Section 23 25 00 – HVAC Water Treatment

1.3 REFERENCES

- A. ASME - Boilers and Pressure Vessel Codes, SEC 8-D-Rules for Construction of Pressure Vessels

1.4 SUBMITTALS FOR REVIEW (REFER TO SECTION 23 05 00)

- A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
- B. Furnish a manufacturer's data report for Pressure Vessels, Form U-1 as required by ASME Boiler Pressure Vessel Code for each compression and expansion tanks.
- C. Submit Selections and sizing for all flow balancing valves (automatic or manual).

1.5 PROJECT RECORD DOCUMENTS (REFER TO SECTION 23 05 00)

- A. Record actual locations of equipment and devices furnished under this section.

1.6 OPERATION AND MAINTENANCE DATA (REFER TO SECTION 23 05 00)

- A. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 DELIVERY, STORAGE, AND HANDLING (REFER TO SECTION 23 05 00)

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.

- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 AIR SEPARATORS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Spirotherm
 - 2. Taco Series 4900 - AD
 - 3. Wessels Wess – Vent
 - 4. Armstrong DAS
- B. Construction and design:
 - 1. In-line design, 150 psi working pressure
 - 2. ASME SEC 8-D construction
 - 3. Brass construction for sizes 1½ inches and smaller
 - 4. Steel construction for sizes 2 inches and larger
 - 5. Turbulence suppressive type air eliminator to separate micro bubbles and to remove stationary air pockets through absorption
 - 6. Copper or stainless steel coalescing medium
 - 7. Integral brass venting mechanism at top of unit
 - 8. Side valve to remove floating liquids and debris from the surface
 - 9. Threaded blowdown connection port at bottom
 - 10. Sized for maximum water velocity of 4 fps and maximum pressure drop of 1.5 feet WG.

2.2 AIR VENTS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Bell and Gosset
 - 2. Hoffman
 - 3. Spirotherm
 - 4. Taco
 - 5. Caleffi
- B. Manual Type:
 - 1. Basis of Design: Bell and Gossett, No. 4V
 - 2. 1/8 inch coin or screwdriver operated, brass connection
- C. Automatic Type:
 - 1. Basis of design: Bell and Gossett, No. 87
 - 2. Brass or semi-steel body, copper float, stainless steel valve and valve seat; suitable for system operating temperature and pressure (150 psi at 240 °F minimum); with isolating valve
 - 3. Air vent shall be tapped for 1/8 inch IPS.
- D. Automatic Type: High Capacity
 - 1. Basis of design: Bell and Gossett, No. 107A
 - 2. Non-modulating high capacity air vent design to purge free air from the system and provide positive shutoff at pressures up to 150 psig at a maximum temperature of 250 °F. The design of the high capacity air vent shall prevent air from entering the system if system pressure should drop below atmospheric pressure. The high capacity air vent shall be pilot operated for intermittent purging of free air at pressures up to 2 psig during normal system operation, and diaphragm operated for full capacity purging of free air at pressures between 2 to 150 psig.
- E. Manual Type: High Capacity
 - 1. Short vertical sections of 2 inches diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber

2.3 BALANCING COCKS

- A. Balancing cocks where indicated shall be ball or butterfly valves as specified in Section 23 05 23.

2.4 EXPANSION TANKS

- A. Manufacturers: (Refer to Section 23 05 00):
1. Amtrol
 2. Armstrong
 3. Bell and Gossett
 4. Taco
 5. Wessels
- B. Construction:
1. Bladder Type: Welded steel; tested and stamped in accordance with ASME SEC 8-Div. 1; cleaned; prime coated; fitted with lifting rings and steel support saddle; tappings for installation of accessories; supplied with National Board Form U-1; 125 psi pressure rating; field-replaceable heavy duty butyl rubber bladder; air charging valve (standard tire valve); tank drain
 2. Tank shall be full or partial acceptance as scheduled.
- C. Accessories:
1. Manual air vent
 2. Pressure relief valve: Select for pressures noted on the drawings.
 3. Water pressure gauge: Install at system connection.
 4. Air pressure gauge: charging valve indicated above shall be independent of gauge, and shall be accessible without removal of gauge.

2.5 FLOW CONTROL BALANCING VALVES (MANUAL) – “CIRCUIT SETTERS”

- A. Manufacturers (Refer to Section 23 05 00):
1. Armstrong
 2. Bell and Gossett
 3. Nibco
 4. Taco
 5. Victaulic by Tour and Anderson
- B. General: Precision machined orifice with memory stop; calibrated external name plate and direction arrow. Flow control balancing valves shall have tight shut-off and 2 meter taps, each with internal check valve and thread protector. Component construction and materials shall be suitable for application.
- C. Valves Serving Design Flows of Greater than 30 gpm: Valve adjustment shall occur over a minimum of 720° adjustment rotation.
- D. Circuit Setters shall be sized for a minimum of 2 foot water pressure drop and a maximum of 5 foot drop at design flow rate.
- E. Connections:
1. Up to 2 inches: Threaded or sweat
 2. 2½ inches and larger: Flanged
- F. Flow control balancing valves shall be sized based on scheduled equipment flow rate according to the manufacturer's guidelines.

2.6 REDUCING VALVES

- A. Manufacturers (Refer to Section 23 05 00):
1. Bell and Gossett
 2. Taco
 3. Armstrong

- B. Brass body with integral check valve; manual fast fill feature; cleanable strainer
- C. Discharge pressure
 - 1. Provide reducing valve to meet fill pressure requirements scheduled on the expansion tank schedule.
 - 2. Factory setting 12 psig (adjustable 10-25 psig)
 - 3. Factory setting 45 psig (adjustable 25 to 60 psig)

2.7 SAFETY RELIEF VALVES

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Bell and Gossett
 - 2. Taco
- B. Basis of Design:
 - 1. Bell and Gossett Series 790 and 1170
- C. Construction:
 - 1. Body: Brass
 - 2. Diaphragm and Seat: EPDM
 - 3. Internal Wetted Parts: Brass
 - 4. ASME labeled, diaphragm assisted
 - 5. Maximum Working pressure 125 psig
 - 6. Maximum operating temperature 250 F
 - 7. Relief setting: As indicated on drawings

2.8 STRAINERS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Sarco
 - 2. Strong, Dunham Busch
 - 3. Webster
 - 4. Watson McDaniel
- B. Size 2 inch and under:
 - 1. Basis of Design: Sarco IT, BT
 - 2. Screwed brass or iron body for 250 psig working pressure Y pattern with 1/32 inch stainless steel perforated screen
 - 3. Accessories: 3/4 inch blow-off valve and cap
- C. Size 2½ inch to 8 inch:
 - 1. Basis of Design: Sarco CI-125
 - 2. Flanged iron body for 147 psig working pressure; Y pattern with 3/64 inch stainless steel perforated screen
 - 3. Accessories: 3/4 inch blow-off valve and cap

2.9 VENTURIS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Barco
 - 2. Hyspan
 - 3. HCI
 - 4. Nexus
- B. Precision machined orifice with tag indicating size and flow ratings. Fittings shall have two meter taps, each with shut-off cock and thread protector.

2.10 PUMP SUCTION FITTINGS

- A. Provided under Section 23 21 23.

2.11 GLYCOL FILL ASSEMBLY

- A. Provided under Section 23 25 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
1. Provide specialties in accordance with manufacturer's instructions and as indicated on the drawings.
 2. Where large air quantities can accumulate, provide enlarged air collection standpipes.
 3. When pumps are piped in parallel, provide the following:
 - a. Shut-off valve(s), balance valve, non-slam check valve. (Combination valves are not allowed).
 4. Provide access doors where specialties are not exposed unless indicated to be provided under other divisions. Access doors shall comply with Division 8. Coordinate size and location with access requirements.
- B. Air Separators:
1. Provide air separator on suction side of system circulation pump.
- C. Air Vents:
1. Provide automatic air vents where indicated on the drawings. Provide isolation ball valve at each vent for future service of vent.
 2. Provide manual air vents at system high points and as indicated.
 3. Provide high capacity air vent at the air separator as specified with the air separator.
 4. Provide threaded ½ inch ball valve between high capacity and automatic air vents and line served. Pipe connection to be ½ inch minimum.
 5. Provide manual air vents on all water coils and at high points of piping systems. All air vents shall have a manual shutoff.
- D. Flow Control Balancing Valves:
1. Provide flow control balancing valves at all water coils, pumps, re-circ pump, pipe mains and equipment as indicated.
 - a. Install flow control balancing valves with meter connections upward.
 2. Valves shall be sized as noted in Part 2 Products. Provide concentric reducers on either side of valve when valve is smaller than line size.
- E. Relief Valves:
1. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.
 2. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
 3. Install relief valves without a vertical lift on the outlet piping.
 4. Pipe relief valve outlet to nearest floor drain for water systems or glycol feeder for glycol systems.
 5. Where location of glycol feeder will not allow relief piping to be installed without a vertical lift, provide a chemical drum adjacent to relief valve and pipe relief valve to the drum.
 6. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- F. Strainers:
1. Provide ¾ inch valved drain and hose connection on strainer blow down connection.
 2. Provide strainer upstream of all control valves, coils, reducing valves, traps and other devices with orifices.
- G. Venturis:

1. Install venturi flow devices with required straight lengths of piping upstream and downstream of valve according to the manufacturer's recommendations.

END OF SECTION

SECTION 232123
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Base-Mounted Circulating Pumps
- B. Multistage In-Line Circulating Pumps

1.2 RELATED SECTIONS

- A. Division 3 – Cast-in-Place Concrete
- B. Section 23 05 00 – Common Work Results for HVAC
- C. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
- D. Section 23 05 19 – Meters and Gauges for HVAC Piping
- E. Section 23 05 23 – General Duty Valves for HVAC Piping
- F. Section 23 05 48 – Vibration Controls for HVAC
- G. Section 23 05 49 – Seismic Controls for HVAC
- H. Section 23 05 93 – Testing, Adjusting, and Balancing
- I. Section 23 07 00 – HVAC Insulation
- J. Section 23 09 95 – Variable Frequency Drives
- K. Section 23 21 13 – Hydronic Piping
- L. Section 23 21 16 – Hydronic Piping Specialties
- M. Section 23 25 00 – HVAC Water Treatment

1.3 REFERENCES

- A. General
 - 1. UL 778 - Motor Operated Water Pumps
 - 2. NFPA 70 - National Electrical Code

1.4 SUBMITTALS (REFER TO SECTION 23 05 00)

- A. General
 - 1. Construction: Verify each component of the construction requirements of these specifications including casing, impeller, shaft, sleeve, ring, and seat materials. Indicate maximum continuous operating temperature and working pressures. Address requirements for suction and discharge tapings.
 - 2. Performance Information: Provide all information indicated in the equipment schedule for each pump as a minimum including shut-off head, efficiency, brake horsepower, motor horsepower, motor voltage, and motor phase. Impeller diameter shall also be indicated.
 - 3. Pump Curves: Provide certified pump curves for each pump with design flow and pressure plotted. Curves shall be provided on a chart with flow on the x-axis and pressure on the y-axis. Brake horsepower lines shall also be indicated on the chart sufficient to determine the approximate brake horsepower at any given point on the curve. Include NPSH curve when applicable.
 - 4. Accessories: Indicate all accessories to be provided with each pump.
- B. Base-Mounted Circulating Pumps: Indicate baseplate material and assembly. Address requirement for flexible coupling guard. Provide pump suction fitting information indicating body

material and addressing strainer requirements as well as requirements for inlet vanes, removable magnetic insert, and adjustable support foot. Provide manufacturer's installation instructions, including recommended attachment and grouting of pump base.

- C. In-Line Circulating Pumps: Indicate lubrication and sealing of ball bearings. Provide manufacturer's installation instructions, including hanging and support recommendations.

1.5 OPERATION AND MAINTENANCE DATA (REFER TO SECTION 23 05 00)

- A. Include the following minimum information: All pump performance and pump curve information required for equipment submittals; installation instructions; assembly views; replacement parts; and lubrication instructions including lubrication points, type of lubrication to be provided, and frequency of lubrication.

1.6 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.7 EFFICIENCY STANDARDS

- A. Pumps that require a 15 % or greater increase in brake horsepower than the scheduled equipment to meet the design flow and pressure requirements will not be considered equal and will not be accepted.

1.8 EXTRA MATERIALS (REFER TO SECTION 23 05 00)

- A. Provide one (1) spare set of mechanical seals for each pump.

1.9 DRAWING SCHEDULES

- A. Refer to drawings for specific capacities, dimensions, accessories, and other requirements supplemental to these specifications.

PART 2 - PRODUCTS

2.1 BASE MOUNTED END SUCTION CIRCULATING PUMPS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Armstrong
 - 2. Bell & Gossett
 - 3. Taco
- B. General: Base-mounted; close coupled; single stage; end suction. The seal shall be serviceable without disturbing the piping connections.
- C. Construction: Cast iron casing with pedestal support feet; cast bronze impeller, dynamically balanced and keyed to shaft; stainless steel or replaceable bronze shaft sleeve; carbon seal ring and ceramic seat; drain port; structural or fabricated steel baseplate and securely welded cross-members; flexible coupling with ANSI/OSHA guard; 175 psi maximum working pressure; 225 °F maximum continuous operating temperature
- D. Pump casing shall have suction and discharge gauge tapings.
 - 1. Exception: Pumps that do not have gauge tapings shall be provided with gauge tapings in the connected piping on both the suction and discharge sides.
- E. Pump Suction Fitting: Angle pattern; cast iron body; inlet vanes; cylinder strainer with 3/16 inch diameter openings; disposable fine-mesh strainer over cylinder strainer; magnetic insert removable for cleaning; adjustable support foot.
 - 1. Exception: Pump suction fittings that do not have an integral support foot shall be provided with an adjustable pipe stand.

2.2 IN-LINE CIRCULATING PUMPS

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Armstrong
 - 2. Bell & Gossett
 - 3. Taco
 - 4. Goulds
- B. General: In-line; multi-stage; suitable for horizontal or vertical installation; capable of being serviced without disturbing piping connections.
- C. Construction: stainless steel casing; stainless steel impeller with internal thrust balance at each stage; alloy steel shaft sleeve; ceramic bearings; mechanical silicon carbide, EPR seal; each stage shall have a bowl with attached diffuser constructed of stainless steel; self-centering wear wrings constructed of PPS; 360 psi maximum working pressure; 225 °F maximum continuous operating temperature
- D. Pump casing shall have gauge tappings at the suction and discharge nozzles.
 - 1. Exception: Pumps that do not have gauge tappings shall be provided with gauge tappings in the connected piping on both the suction and discharge sides.

2.3 VFD CONTROLLED PUMPS

- A. All VFD controlled pumps (see VFD schedules on drawings) shall be provided with shaft grounding rings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that electrical power is available and of the correct characteristics.

3.2 GENERAL

- A. Provide pumps in accordance with manufacturer's instructions and as indicated.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. When pump connections are smaller than piping line-size, decrease from line size with long radius reducing elbows or reducers. Pipe-size reduction shall occur near the pump connection, with all valving associated with the pump being of piping line-size.
- D. Support piping adjacent to pump such that no weight is carried on pump casings.
- E. Provide air cock and drain connection on horizontal pump casings.
- F. Lubricate pumps before start-up.
- G. Provide single pressure gauge at each pump with isolation gauges to isolate total, suction and discharge pressures. See Section 23 05 19.

3.3 BASE MOUNTED CIRCULATING PUMPS

- A. Provide supports under elbows on pump suction and discharge line for pipes size 4 inch and over. Refer to Section 23 05 48.
- B. Provide line-size shut-off valve and pump suction fitting on pump suction. Provide separate line-size shut-off valve (and non-slam check valve where indicated) on pump discharge.
- C. Manufacturer's representative shall check, align, and certify alignment of base mounted pumps prior to start-up and provide start-up services. Measure vibration on pumps to insure it is within limits of Section 23 05 48 and the manufacturer requirements. Submit start-up reports to the Owner's representative.

- D. Install on concrete housekeeping base with anchor bolts. Set and level, and grout in place. Refer to Division 03.
 - 1. Exception: Pumps shown on drawings to be mounted on inertia bases. Refer to Section 23 05 48.
- E. Connect piping to pump with neoprene flexible pipe connectors. See Section 23 05 48.

3.4 IN-LINE CIRCULATING PUMPS

- A. Provide line-size shut-off valve and strainer on pump inlet. Provide separate line-size shut-off valve (and non-slam check valve where indicated) on pump discharge.
- B. Provide union on each side of pump if pump body does not have flanged connections.
- C. Provide pump motor support with spring isolation hanger when pump motor is installed in horizontal position.

END OF SECTION

SECTION 232500
HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cleaning of piping systems
- B. Chemical feeder equipment
- C. Chemical treatment
- D. Equipment, valves, controls and connections to systems
- E. Electrical wiring of components to source unless indicated otherwise

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Section 23 09 23 – Direct-Digital Control for HVAC
- C. Section 23 64 16 – Centrifugal Water Chillers (Water Cooled)
- D. Section 23 65 00 – Cooling Towers

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code

1.4 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.
- B. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
- C. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- D. Cleaning and flushing plan.
- E. Manufacturer's Field Reports (Refer to Section 23 05 00):
 - 1. Indicate analysis of existing systems prior to making connections to new systems in accordance with Section 23 05 05.
 - 2. Indicate start-up of treatment systems when completed and operating properly.
 - 3. Indicate analysis of system water after cleaning and after treatment.

1.5 PROJECT RECORD DOCUMENTS (REFER TO SECTION 23 05 00)

- A. Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

1.6 OPERATION AND MAINTENANCE DATA (REFER TO SECTION 23 05 00)

- A. Operation and Maintenance Data: Include data on chemical feed pumps, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations. Include the volume of each system.

1.7 QUALIFICATIONS

- A. Manufacturers-Chemicals: Company specializing in manufacturing the products specified in this section with minimum five (5) years documented experience. Company shall have local

representatives with State Certified Laboratories and full time service personnel in the area of the job site.

- B. Installer: Company specializing in performing the work of this section with minimum five (5) years documented experience and who is approved by manufacturer.

1.8 QUALITY ASSURANCE

- A. Start-up, system check, water samples, analysis, cleaning, flushing, and testing shall be performed by a single water treatment company for undivided responsibility.
- B. Company shall only utilize qualified personnel active in the field of water treatment who are factory trained or authorized.
- C. Analysis, testing and reports shall be performed by a State Certified Lab.

1.9 REGULATORY REQUIREMENTS

- A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and to public sewage systems.
- B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.10 MAINTENANCE SERVICE

- A. Furnish service and maintenance of treatment systems for one (1) year from Date of Substantial Completion.
- B. Provide technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report to the Owner's representative after each visit.
- C. Schedule:
 - 1. Closed loop systems; a minimum of four visits per year on a quarterly basis.
 - 2. Cooling Towers and Fluid Cooler Basin Water Systems: monthly visits during the months that the system is operational. Winterize system and drain tower for the winter. Provide start-up for the system in the spring when mechanical cooling is required.
- D. Provide laboratory and technical assistance services during this maintenance period.
- E. Include training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems in accordance with Section 23 05 00. Arrange course to occur at start-up of systems.
- F. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

1.11 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of 23 05 00.
- B. Provide sufficient chemicals for treatment and testing for one year from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/INSTALLERS (REFER TO SECTION 23 05 00):

- A. Nalco, Rachel Stevens (281-768-9184)

2.2 MATERIALS

- A. System Cleaner:
 - 1. Manufacturers (Refer to Section 23 05 00):
 - a. IAT Construction Services, Inc. Product SP-125DetSol
 - b. Nalco/Ecolab
 - 2. A phosphate wetting agent combined with an alkaline surfactant with a sodium carbonate type alkalinity supplement introduced as necessary to produce 600 ppm of phenolphthalein alkalinity. Chemicals shall be non-toxic.
- B. Closed System Treatment (Chilled Water and Condenser Water Closed System):
 - 1. Manufacturers (Refer to Section 23 05 00):
 - a. IAT Construction Services, Inc., Product CS-537
 - b. King Soft Water: CST-N25
 - c. Flint: CS-39
 - d. Nalco
 - e. Betz
 - 2. Chemical properties:
 - a. Ferrous metal corrosion inhibitor product shall provide corrosion protection by the use of sodium molybdate, sodium nitrate, and sodium borate technique.
 - b. Non-ferrous metal corrosion inhibitor product shall provide corrosion protection by the use of tolytriazole.
 - c. System shall be treated with biocides to prohibit biological growth within the closed system.
 - d. Sequestering agent to reduce deposits and control PH.
- C. Condenser Water Open System Treatment (Basin of Closed Circuit Fluid Coolers).
 - 1. Manufacturers (Refer to Section 23 05 00):
 - a. Inland Aquatech, Product CT-853G
 - 2. Corrosion inhibitor shall be an organophosphonate base, capable of sequestering up to 500 PPM of total hardness without the need for acid PH control. Ferrous metal corrosion protection shall be provided by molybdate levels of 3 to 6 PPM as mo. Non-ferrous corrosion protection shall be provided by tolytriazole at 3 to 5 PPM.
 - 3. Micro-biocide - At least two different chemical formulations shall be utilized for this portion of the chemical treatment program. Both products shall be liquid form and shall be pre-mixed for pumping direct from the shipping container.
 - a. Primary biocide shall be an oxidizing type micro biocide with product make-up as 1-bromo-3-chlor-5, 5-dimethylhydantoin. Minimum active biocide percentage of 96 %.
 - b. Secondary biocide shall be furnished as a surface active quaternary ammonium, containing a minimum of 15 % active Poly-(oxethylene-(dimethyliminio)-ethylene (dimethyliminio) ethylent dichloride).
 - 4. Products shall be non-polluting, non-fouling, and shall be acceptable to local agencies.
- D. Freeze Protection
 - 1. Manufacturers (Refer to Section 23 05 00):
 - a. DOWFROST
 - b. Interstate Chemical, Product P-300
 - 2. System shall be charged with an inhibited propylene glycol mixed with demineralized water.

2.3 BY-PASS (POT) FEEDER

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. IAT Construction Services, Inc
 - 2. A and F Machine Products
 - 3. JL Wingert
 - 4. Neptune
- B. Quick opening cap for working pressure of 175 psig. Sizes as scheduled below:
 - 1. System volume up to 200 gallons: 1 gallon pot feeder

2. System volume greater than 200 gallons and less than 2000 gallons: 2 gallon pot feeder
3. System volume greater than 2000 gallons: 5 gallon pot feeder

2.4 SOLUTION METERING PUMP

- A. Manufacturers (Refer to Section 23 05 00):
 1. LMI, Series A
 2. Pulsafeeder
- B. Positive displacement, diaphragm pump with adjustable flow rate, thermoplastic construction, continuous-duty fully enclosed electric motor and drive, and relief valve
- C. Electrical Characteristics:
 1. 120 volts, single phase, 60 Hz
 2. Cord and Plug: Provide unit with 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.5 SOLUTION TANKS

- A. Polyethylene, self-supporting, with graduated marking and molded fiberglass cover with recess for mounting pump
- B. Accessories:
 1. Liquid level switch to interface with the temperature control system

2.6 GLYCOL MAKE-UP FEEDER

- A. Manufacturers (Refer to Section 23 05 00):
 1. Advantage
 2. IATCS
 3. Wessels
 4. Axiom
- B. The glycol system shall have the following features with all components mounted on a welded steel stand.
 1. Tank (heating systems where reliefs are pumped back into the tank): 50 gallon carbon steel
 2. Tank (all other systems): 50 gallon polyethylene
 3. Pump: positive displacement
 4. Controller: NEMA 1 enclosure
 5. Electrical:
 - a. 120 volts, single phase, 60 Hz
 - b. Cord and Plug: Provide unit with 6 foot cord and plug for connection to electric wiring system including grounding connector.
 - c. Single point electrical connection
 6. Features:
 - a. Pressure switch factory set: 0-100 psig (field adjustable) Pump shut-off valves
 - b. Pump discharge check valve
 - c. Low water pump protection
 - d. Relief valve
 - e. Pressure gauges
 - f. Power light, pump light, alarm light
 - g. Drain valve
 - h. Removable tank cover
 7. Accessories
 - a. Dry contacts for low water level alarm to be monitored by the building temperature control system.

2.7 GLYCOL RECOVERY TANK

- A. Provide empty spare tank for acceptance of glycol from safety relief valves, minimum 50 gallons, polyethylene, closed/removable top with minimum (2), 2" openings.

2.8 LIQUID LEVEL SWITCH

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. LMI Model 26731 (50 gallon tank)
- B. Polypropylene housing with integrally mounted PVC air trap, receptacles for connection to metering pump, and low level alarm
- C. Electrical Characteristics:
 - 1. 120 volts, single phase, 60 Hz

2.9 COOLING TOWER CONTROLLER

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. MORR, Model M
- B. Control cabinet housing impulse counter, two (2) five minute reset timers, operational lights, and biocide program module for feed and control of up to two micro-biocides.
- C. Controller shall provide fully automated chemical feed and bleed-off control based on water meter measurement of makeup volume, with chemical feed and bleed-off actuated by separate 5 minute automatic reset timer.
- D. System shall include a 24 hour/7 day timer for feed of biocide to cooling tower.

2.10 WATER METER

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Carlton, Series JSJ
 - 2. SeaMetrics
- B. Displacement type cold water meter with sealed, tamper-proof magnetic drive, impulse contact
- C. Size appropriately to water make-up line
- D. Electrical Characteristics:
 - 1. 120 volts, single phase, 60 Hz

2.11 SOLENOID VALVES

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. ASCO (globe Style)
 - 2. Honeywell (ball style)
- B. Outdoor applications: Forged brass body globe pattern, normally open or closed as required, general purpose with a waterproof solenoid enclosure
- C. Indoor applications: Motorized ball valve of all bronze construction, normally open or closed as required, general purpose
- D. Features: manual override
- E. Electrical Characteristics:
 - 1. 120 volts, single phase, 60 Hz

2.12 CONDUCTIVITY CONTROLLER

- A. Manufacturers (Refer to Section 23 05 00):
 - 1. Liquitron DC4500 Series

B. Conductivity Controller Standard Features (all or some may apply to the project):

1. LCD Display
2. LED indicators: power, bleed, alarm, flow, feed, timer 1, timer 2
3. Two timers: 1 to 28 day cycles
4. Bleed set point
5. Feed timer
6. Nema 4 enclosure
7. Housing: Flame retardant
8. Cover: 1 clear polycarbonate, locking
9. Electrical
 - a. Input 115 volt, single phase, 60 hertz
 - b. Output and input signals compatible with auxiliary devices

C. Probe assembly: Furnished with controller by the same manufacturer

2.13 TEST EQUIPMENT

- A. Basic water test equipment shall be provided for determination of treatment residuals. This shall include a carrying case and reagents for use with the supplier's products. Where specialized or supplementary equipment is required, it shall be furnished as of the offering.
- B. Test equipment for glycol shall be furnished and approved by the glycol manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Systems shall be operational, filled, hydrostatically tested, started, and vented prior to cleaning. Use water meter to record capacity in each system. Record capacity and include in Operation and Maintenance Manuals.
- B. Mechanical Contractor shall make temporary piping connections, contractor providing work in this section shall furnish temporary pumps, and temporary bypass filter as required to properly accomplish all cleaning operations.
- C. Place all manual and control valves serving main coil banks and terminal control units in open position during cleaning so that circulation through the mains and the runouts is obtained during cleaning.
- D. Initially flush the system with cold water through temporary flushing and drain connection. Flushing shall be sufficient to remove all contaminants, such as cuttings, filings, lubricants, rust, scale, grease, solder, flux, welding residue and debris.
- E. Verify that electric power is available and of the correct characteristics.
- F. Prior to introduction of demineralized water to systems treated with glycol, show demineralization equipment being utilized for the project to the Owner's Representative to obtain sign-off from Owner's Representative and include with start-up reports.

3.2 CLEANING AND FLUSHING WORK PLAN

- A. The chemical treatment contractor shall develop a project specific work plan for cleaning and flushing. The treatment plan shall be coordinated with the piping contractor prior to submission to the Owner's representative.
- B. Work plan shall be submittal with chemical treatment products. Submittals that do not include a treatment plan will be rejected and returned to the contractor without review.
- C. The work plan shall include:
 1. Condition of existing systems per Section 23 05 00.

2. Drawings indicating phasing and duration for input into the general contractors work schedule. Cleaning and flush for each phase shall be indicated on a set of piping plans with each phase of work clearly identified.
 3. Flushing schedule and drawings or diagrams that will be used for inspection and sign off prior to and after procedure, at Owner's option.
 4. Duration of flushing for each pipe system type
 5. Repeat flushing (if required to due to phasing).
 6. Specific procedures used for cleaning and flushing.
 7. Flushing velocities and flow rates with calculations, drawings and diagrams showing sectioning or zoning of piping systems to achieve required velocities, locations and means of temporary bypasses and returns.
 8. Temporary piping connections, temporary pumps and temporary bypass filters. Temporary pump motor size and power source.
 9. Cleaning treatment products
 10. Post treatment chemicals
- D. Provide the CX agent with minimum two weeks notice in advance of each cleaning and flushing activity. Schedule activities during normal business hours as much as practical.

3.3 CLEANING SEQUENCE

- A. Concentration:
1. 1 pound per 100 gallons of water contained in the system.
 2. 1 pound per 100 gallons of water for heating hot water systems and for open loop condenser systems.
 3. 1 pound per 50 gallons of water for closed loop condenser water systems, chilled water and heat reclaim water systems.
- B. Chilled Water Systems and Closed Loop Condenser Water Systems:
1. Completely fill the system with cleaning solution and circulate throughout the system to assure a rapid, efficient clean-up of all suspended solids and foreign material present in the system.
 2. Circulate for twenty-four (24) hours, then drain systems as quickly as possible.
 3. Refill with clean water and flush via the flushing and draining connections for a minimum one (1) hour duration.
 4. Maintaining a full system and continuing the fresh water flush, operate the circulating pump, partially close and reopen all manual valve several times, operate all automatic control valves through several cycles and continue this operation until no further traces of cleaning compound are detected and until there is no evidence of particulate matter in the system.
 5. Drain the system. Clean all strainers. After cleaning strainers and removal of start-up strainers, refill the system with clean water, circulate for thirty (30) minutes and drain system. Following the final flushing operation, fill the piping with fresh water.
- C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.
- D. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.
- E. Add specified treatment chemicals as soon as possible after cleaning and flushing. Treatment chemicals must be added within two (2) hours of filling system with clean water.
- F. The cleaning firm shall, upon completion of cleaning and chemical treatment addition, tag each system so that tag is plainly visible as follows: "THIS SYSTEM HAS BEEN CHEMICALLY CLEANED AND TREATED". Each strainer shall additionally be tagged indicating strainer has been cleaned and date of cleaning.

3.4 INSTALLATION

- A. Furnish and install all devices as specified in this section and indicate on the drawings in accordance with manufacturer's instructions.
- B. All piping and wiring for chemical treatment shall be provided under this section unless indicated otherwise on the drawings.
- C. Systems shall be complete and shall be installed in strict accordance with the manufacturer's diagrams and recommendations; including all piping and electrical work.
- D. The manufacturer's representative shall be responsible for assisting the contractor during construction and shall charge the systems.
- E. Solution tanks and solution metering pumps: Pump location shall be a maximum of 24 inches above the top of the chemical barrel to avoid excessive suction lift. Chemical shall be pumped direct from the shipping container.
- F. Closed Condenser Systems (Basins of Closed Circuit Fluid Coolers): Injector piping installed outdoors shall be strapped to cold water make-up pipe prior to insulation and heat trace of pipe.
- G. Extension of existing systems: Refer to Section 23 05 05.

3.5 CLOSED SYSTEM TREATMENT

- A. Provide bypass pot feeder for each system when indicated on the drawings. Install isolating and drain valves and necessary piping. Pipe bypass feeder drain valve to the nearest floor drain. Install with the inlet of the feeder connected to the discharge side of the pump and the outlet of the feeder connected to the suction side of the pump.
- B. Introduce closed system treatment through bypass feeder (or glycol make-up feeder) when required or indicated by test.
- C. Freeze Protection:
 - 1. Introduce inhibited glycol solution through the glycol make-up feeder.
 - 2. Introduce inhibited glycol from a solution tank through a solution metering pump as indicated by the system pressure switch. Install as detailed on the drawings.
 - 3. Charge the following systems to the glycol concentrations indicated:
 - a. Chilled Water 20 %
 - b. Condenser Water 30 %
 - 4. Provide glycol recovery tank for acceptance of glycol solution from safety relief valves.
 - 5. Install per manufacturer's recommendations adhering to compatible make-up water and inhibitor requirements.
- D. Provide ¾ inch water coupon rack around circulating pumps as indicated on plans with space for 4 test specimens to monitor system scale and corrosion. Spec writers note: use this only on large systems or when requested by an Owner.

3.6 SUPPLEMENTAL REQUIREMENTS

- A. At project closeout, installer shall be represented at final observation meeting by qualified personnel with equipment and two (2) copies of start-up reports.
 - 1. Owner's Representative may choose and direct spot checking of system cleaning via strainer removal & blow-down. Systems not observed to be cleaned shall be re-drained, cleaned and flushed with appropriate chemicals re-introduced into system. This shall occur at no additional cost to the Owner.

END OF SECTION

SECTION 236500
COOLING TOWERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cooling Tower - forced draft closed type (fluid cooler)
- B. Controls
- C. Ladder and Handrails
- D. Circulating pump
- E. Basin Sweeper Package

1.2 RELATED SECTIONS

- A. Section 23 05 00 – Common Work Results for HVAC
- B. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
- C. Section 23 05 48 – Vibration Controls for HVAC
- D. Section 23 05 49 – Seismic Controls for HVAC

1.3 REFERENCES

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings
- B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings
- C. ASME PTC-23 - Atmospheric Water-Cooling Equipment
- D. ASTM E84 - Surface Burning Characteristics of Building Materials
- E. NFPA 70 - National Electrical Code

1.4 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Section 23 05 00.
- B. Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.
- C. Product Data: Provide rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls.

1.5 SUBMITTALS AT PROJECT CLOSEOUT (REFER TO SECTION 23 05 00)

- A. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include cleaning methods and cleaning materials recommended.

1.6 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- B. The Cooling Tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed according to the plans. If, because of a suspected thermal performance deficiency, the Owner chooses to conduct an on-site thermal performance test under the supervision of a qualified disinterested third party in accordance with CTI or ASME standards during the first year of operation; and if the tower fails to perform within

the limits of test tolerance; then the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are appropriate and agreeable to the Owner to compensate for the performance deficiency.

1.7 DELIVERY, STORAGE, AND HANDLING (REFER TO SECTION 23 05 00)

- A. Factory assemble entire unit. For shipping, disassemble into as large as practical sub-assemblies so that minimum amount of field work is required for re-assembly.
- B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (REFER TO SECTION 23 05 00):

- A. Reymsa
- B. Or Approved Equal

2.2 MANUFACTURED UNITS

- A. Provide outdoor units, factory assembled, induced draft, counter-flow, closed-circuit fluid cooler. The closed-circuit fluid cooler shall consist of basin section with copper coil, fan and re-circulating pump system.

2.3 COMPONENTS

- A. Construction: The closed-circuit fluid cooler is designed and constructed to withstand wind pressure of no less than 30 pounds-forces per square foot (psf) on external surfaces. The top of the closed circuit fluid cooler's body shall be designed and constructed to withstand a live load of no less than 40 pounds-forces per square foot (psf) in addition to the concentrated loads of the fan or other equipment mounted thereon. Unit shall be provided with structural base for direct installation on concrete pad.
- B. Basin Section: The closed-circuit fluid cooler has one seamless piece basin section, water-tight and leak-proof piece, constructed of corrosion-resistant material with Ultraviolet (UV) inhibitor, high-grade Isophthalic Polyester Resin. The Fiberglass Reinforced Polyester (FRP) wall have a thickness no less than 1/4 inch, to ensure the structural strength, the framing structural members, the basin's structure, walls and bottom must be specially reinforced. No side fasteners will be allowed at the sidewalls of the basin. There are no metal supports or structure in direct contact with water.
 - 1. Fitting of 3 inch and smaller are NPT, and fittings larger than 3 inch use ANSI flange.
 - 2. A standard make-up water mechanical float valve is provided
- C. Body Section: The closed circuit fluid cooler has one seamless piece body section, water-tight and leak-proof, constructed of corrosion-resistant material with Ultraviolet (UV) inhibitor, high-grade Isophthalic Polyester Resin. The Fiberglass Reinforced Polyester (FRP) wall have a thickness no less than 1/4 inch; to ensure the structural strength, the framing structural members, the body's structure, are specially reinforced.
- D. Fan Duct: The closed-circuit fluid cooler has two fan ducts constructed of corrosion-resistant material with Ultraviolet (UV) inhibitor, high-grade Isophthalic Polyester Resin. The Fiberglass Reinforced Polyester (FRP) wall has a thickness no less than 1/4 inch; the fan duct is specially reinforced to ensure its structural strength. The Fan Duct contains a direct-drive fan, a motor mounted on an FRP structure, and corrosion-resistant safety screen mesh fan guard.
- E. Fans: The closed-circuit fluid cooler has two fans. Fans are direct-drive, with axial, propeller type fan blades. Fan blades are manufactured of spark and corrosion resistant reinforced fiberglass, and are suitable for operation on a temperature range of -40 Deg. F to 230 Deg. F. Fan hubs are manufactured of a pressure die cast aluminum alloy.

- F. Fan Motors: The closed circuit fluid cooler has two fan motors. The fan motor is single speed, Totally Enclosed Air Over (TEAO). Fan motor's construction is 100% cast iron and has Class F Insulation System. The fan motor meet NEMA MG1 – 1.26.6, has a Division 2 CSA certification nameplate for hazardous locations, Class I Groups A, B, C and D, and is Underwriters Laboratories (UL) Recognized, and CSA Certified. See section 230513 for additional requirements.
- G. Fill Media Modules: Fill media modules are fabricated from rigid, corrugated UV protected Polyvinyl Chloride (PVC) sheets that are conducive to cooling water. Polyvinyl Chloride (PVC) corrugated sheets form a cross-corrugated pattern to provide a continuous and horizontal redistribution of air and water. The manufacturing material, Polyvinyl Chloride (PVC), are resistant to rot, fungi, bacteria and organic/inorganic acids, and alkalis as commonly found in closed circuit fluid coolers; and meet CTI STD-136. Fill media modules' flame spread rating is less than 20 according to ASTM E84; and regarding flammability, fill media is self-extinguishing in less than 5 seconds according to ASTM D635.
- H. Drift Eliminators: Drift eliminators are fabricated from rigid, corrugated UV protected Polyvinyl Chloride (PVC) sheets and is furnished in lightweight, easily removable sections. Drift losses not to exceed 0.0005% of the design circulating flow. The manufacturing material, Polyvinyl Chloride (PVC), are resistant to rot, fungi, bacteria and organic/inorganic acids, and alkalis as commonly found in closed circuit fluid coolers, and meet CTI STD-136. Drift eliminators' flame spread rating is less than 25 according to ASTM E84, and regarding flammability, drift eliminators are self-extinguishing.
- I. Air Inlet Louvers: Air inlet louvers are cellular type and designed to minimize splash-out of falling water, reduce light transmission into the closed circuit fluid cooler and reduce sound transmission out of the closed circuit fluid cooler at minimal airside pressure loss. Air inlet louvers are fabricated from rigid, corrugated UV protected Polyvinyl Chloride (PVC) sheets and are easily removable to provide access for cleaning. The manufacturing material, polyvinyl chloride (PVC), are resistant to rot, fungi, bacteria and organic/inorganic acids, and alkalis as commonly found in closed circuit fluid coolers, and meet CTI STD-136. Air Inlet Louvers' flame spread rating is less than 20 according to ASTM E84, and regarding flammability, air inlet louvers are self-extinguishing in less than 5 seconds according to ASTM D635.
- J. Hot Water Distribution System: Hot water enters into the closed circuit fluid cooler through a single inlet. All interior distribution piping is Polyvinyl Chloride (PVC) schedule 80 pipe. Water is evenly distributed over the fill media by removable 2 1/2 inch spray nozzles made of Polypropylene (PP). Spray nozzles contain internal, interchangeable flow devices to provide an optimal spray pattern within the 2 to 10 psig operating pressure range.
- K. Water Distribution Pan: Cooled water is distributed externally over the copper coil heat exchanger using gravity spray nozzles placed in a fiberglass pan, so water is evenly spread across the copper coil for better heat transfer.
- L. Cool Water Recirculation Pump: Close coupled, bronze fitted, centrifugal inline pump with mechanical seal, mounted on piping. Pump Motor (Refer to Section 23 05 13): Single speed open drip proof mounted on pump body
- M. Copper Coil: The copper coil tubes are constructed of 5/8 OD Type L copper. The coil is encased in a stainless steel frame, leak tested at 300 psi.

2.4 ACCESSORIES:

- A. Basin Heater: The closed-circuit fluid cooler is provided with a basin heater system. The basin heater system consist of electric immersion basin heater(s) each with one control panel for freeze protection down to -20°F and a combination level sensor/thermostat well, to be field installed. Immersion basin heaters have 334 stainless steel sheaths. The combination level sensor/thermostat well consist of a stainless steel low water probe with a brass and copper thermostat well mounted on a stainless steel MPT plug. Basin heaters enclosure furnished with NEMA 4X Glass Reinforced Polyester, stainless steel captive screws, a hinged silicone gasket

cover, and meet flammability rating 4L94V-O. Basin heater system's contactor is a resistive silver-cadmium oxide contactor rated for 40 amperes.

- B. Electric Water Level Control: The closed-circuit fluid cooler shall be provided with one electric water level control system, to be field installed. The electric water level control system shall consist of one 5-probe water level controller and one stilling chamber. Water level controller's enclosure shall be furnished with NEMA 4X Glass-Filled Polycarbonate, shall have a full gasket cover, and shall meet flammability rating U194V-1. Water level controller's electrodes shall be 1/4 inch stainless steel probes and shall sense high water alarm, low water alarm, high water level, and low water level using a common ground. Stilling chamber shall consist of a 2 inch Polyvinyl Chloride (PVC) schedule 80 Body, 1/2 inch Male Pipe Thread (MPT) Polyvinyl Chloride (PVC) schedule 80 mounting nipples, and 1/2 inch MPT drain plug.
- C. Vibration Switch: The closed circuit fluid cooler is provided with two vibration cut-out switch for shutdown of fan motors. The vibration switch is field installed. Vibration switch case are equal to NEMA 3R. Vibration switch contacts are Single Pole Double Throw (SPDT)-double make leaf contacts for 5 amperes @ 480 VAC.
- D. Ladder with Standard Supports: Aluminum ladder is welded construction, with standard supports, ready to be installed to the cooling tower by others; hot dip galvanized steel fasteners are provided by manufacturer. Supports' construction material are hot dip galvanized steel.
- E. Perimeter Handrail: Perimeter handrail is welded construction in several sections, ready for field assembly and installation; hot dip galvanized steel fasteners are provided by manufacturer. Handrail meet OSHA 1910.23 standard and the 2015 International Building Code. Perimeter handrail's construction material are hot dip galvanized steel.
- F. Catwalk: Catwalk is a one-section non-skid welded construction plate, ready for field installation; hot dip galvanized steel fasteners shall be provided by manufacturer. Catwalk meet OSHA 1910.23 standard and the 2015 International Building Code. Catwalk's construction materials are hot dip galvanized steel.
- G. Fan Removal and Service: Support is welded construction, ready for field installation and is capable of lifting, extending and lowering the fan motor. Support construction is stainless steel.
- H. Base Support shall be hot dipped galvanized steel support structure.
- I. Electrical Panel and Controls: Power Distribution Panel. Includes MCCB w/Disconnect, for spray pump (7.5HP), (2) fans (7.5HP) with by-pass, basin heater relay with spray pump interlock. 120v transformer, NEMA enclosure. Panel shipped loose for field mounting and wiring.

2.5 BASIN SWEEPER PAKCAGE (PRICING PROVIDED AS BID ALTERNATE #1)

- A. Manufacturers (See section 23 05 00):
 - 1. United Industries
 - 2. Or Approved Equal
- B. Unit shall be factory assembled skid mounted system, provided with all separator system components, including separator, automatic purge valve and controls, pump, motor strainer and motor controls.
- C. Separator: Flanged inlet and outlet connections; Sch 40 steel construction; schedule 40 steel construction; exterior primer after wire brush cleaning; exterior finish coating of industrial grade enamel; 150 PSI maximum operating pressure; 120°F maximum operating temperature, clean out port; inlet/outlet pressure gauges; plugged port for air bleed, and fpt purge connection.
- D. Purge: Automatic purge valve assembly factory plumbed and wired. Includes: 2-way brass ball valve with 24 VAC fail-safe actuator that closes in the event of power fail- ure; a 2-way manual brass ball valve for isolation; clear PVC pipe for viewing purge liquid clarity; all fittings for complete installation to separator purge connection; purge control timer in control panel.

- E. Base: skid base fabricated of structural steel channel and/or tube, primed and coated (same as separator coatings).
- F. Pump: Non self-priming; standard fitted, horizontal flooded suction, close coupled to a TEFC motor, as scheduled on drawings.
- G. Motor: See section 230513 for motor requirements, and drawings for motor electrical characteristics.
- H. Strainer: Cast iron body; stainless steel basket; bolted cast iron cover with gasket; with necessary eccentric reducer for pump connection; and gaskets, bolts and nuts necessary for complete factory assembly.
- I. Controls: UL®/cUL® Listed control panel with: NEMA 4X enclosure, IEC motor starter with run- ning light and overload protection; transformer to convert primary supply to 120 VAC control power and 24 VAC power supply for automatic purge valve; fused branch and control circuit protection; through-the-door power disconnect; pump HOA switch with contacts for remote pump on/off from building management system; purge duration and frequency control timer; and manual purge push-button.
- J. Accessories: Provide with inlet and outlet isolation valves for service.

2.6 PERFORMANCE

- A. See schedule on drawings for Model No. capacities, and additional information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that openings are ready to receive work.
- B. Verify field measurements are as shown on Drawings.
- C. Verify that required utilities are available, in proper location, and ready to use.
- D. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

- A. Provide and install in accordance with manufacturer's instructions and as indicated on drawings.
- B. Install tower on structural base, provided by manufacturer. Tower shall be installed level in accordance with the manufacturer's requirements.
- C. Connect tower water piping with flexible connections to tower. Refer to Section 23 05 48.
- D. Connect make-up water piping with flanged or union connections to cooler. Pitch to cooler. Pipe drain, overflow drain, and bleed line to nearest floor drain. Refer to Section 22 05 03.
- E. Provide install all valves, piping and connections required to make tower functional.

3.3 MANUFACTURER'S FIELD SERVICES (REFER TO SECTION 23 05 00)

- A. Prepare and start cooling tower by a factory authorized and trained technician.
- B. Inspect tower after installation and submit report verifying installation and performance is in accordance with specifications and manufacturer's recommendations. Provide report for O&M Manual.
- C. Allow time for start-up and instructions of Owner's operating personnel.
- D. Adjust water level float valves and float controls for proper operating level.
- E. Adjust bleed valve for proportion of circulated water.

- F. Adjust temperature controls and verify operation.

END OF SECTION

DIVISION 26

SECTION 260101
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

- A. Refer to instructions to bidders, general conditions, supplementary general conditions, and Division 1 of these specifications that govern work under Division 26. Refer to other sections of these specifications for additional related requirements.

1.2 SCOPE OF WORK

- A. The work covered by the Electrical Section (Division 26) of the specifications shall include:
 - 1. Furnishing all materials and supplying all labor, equipment and services to install the electrical systems as shown on the accompanying drawings and specified herein.
 - 2. Testing and adjusting of the completed electrical systems in the manner described herein.

1.3 CODES, PERMITS AND FEES

- A. Electrical work shall be in complete accordance with the latest revised edition of the following:
 - 1. National Electrical Code
 - 2. International Building Code
 - 3. International Mechanical Code
 - 4. International Fire Code
 - 5. Americans with Disabilities Act
 - 6. Electrical Safety Orders of the State Department of Labor and Industries
 - 7. Regulations of the State Fire Marshal
 - 8. Regulations of the State Board of Fire Underwriters
 - 9. Administration (WISHA)
 - 10. Washington Administrative Code
 - 11. Applicable sections of other State and local codes
- B. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Owner's Representative in writing of such differences.
- C. The Contractor, at their expense, shall obtain permits and inspections required for the electrical work on this project. Inspection certificates shall be included in the Operation and Maintenance Manuals. Deliver copies thereof to the Architect prior to final acceptance of the work.
- D. Comply with serving company regulations.

1.4 INTENT AND INTERPRETATIONS

- A. It is the intent of these specifications and the accompanying drawings to result in a complete electrical installation in complete accordance with all applicable codes and ordinances.
- B. The drawings and specifications are intended to supplement each other and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are necessary to properly complete the installation of the indicated systems or to render the systems operational, shall be provided, unless specifically excluded.
- C. In the event that any discrepancies of any kind exist, or that required items or details have been omitted, the Contractor shall notify the Engineer in writing of such discrepancy. Failure to do so shall be construed as the willingness of the Contractor to supply all necessary materials and labor required for the proper completion of this work.

1.5 DEFINITIONS

- A. The term "The Contractor", when used in Division 26 of the specifications, shall be construed to mean the Contractor for the electrical work.
- B. The term "Electrical Systems Installer", where used in Division 26 of the specifications, refers to the firm, licensed by the State to perform electrical installation, which is responsible for immediate supervision of electrical work on the project.
- C. The word "provide", where used in this specification and on the accompanying drawings, shall mean furnish and install.

1.6 DRAWINGS

- A. The Electrical Drawings shall serve as the working drawings for the electrical work, but the Architectural Drawings shall take precedence over the Electrical Drawings if any dimensional discrepancies exist. The Electrical Systems Installer shall review the plans for the work of the other trades and shall adjust their work to conform to all conditions indicated thereon.
- B. Work covered under Division 26 has been indicated on the drawings in locations that should allow installation without interfering with the work of other trades; however, exact finish locations have not been indicated. Therefore, locations of all work and equipment shall be verified to avoid interferences, preserve headroom, provide access for maintenance and keep openings and passageways clear. Changes shall be made in locations of equipment and materials as required to accomplish these purposes without additional claims or charges by the Contractor.
- C. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a 10 foot radius of the indicated location. Where connection points are not within this radius, the Contractor shall contact the Engineer for a decision before proceeding or may proceed at their own expense.
- D. At the beginning of the work, the Contractor shall set aside one complete set of the drawings which shall be maintained as a complete Record Drawings set. The Record Drawings set shall include one set of drawings for the facility conduit plan prepared by this Contractor as described in paragraph 2.4 below. Notations shall be done in a neat and legible manner.
 - 1. The record drawings shall be updated daily by the foreman to show every change from the original drawings and the exact locations, sizes and kinds of equipment. This set of drawings shall not be used for any other purpose and shall be maintained at the job site and available for review at any time.
 - 2. Record drawings shall indicate actual size of electrical equipment routing of major raceway systems and location of control devices.
 - 3. The actual location and elevation of all buried lines, boxes, monuments, stub-outs and other provisions for future connection shall be shown on the record drawings and shall be referenced to the building lines or approved bench marks.
 - 4. Upon completion of the job, the Contractor shall deliver the record drawings marked-up to the Engineer.
- E. By the act of submitting a bid, the Contractor shall be deemed to have:
 - 1. Examined the site and familiarize themselves with the conditions affecting the work. No additional allowance shall be granted because of lack of knowledge of such conditions.
 - 2. Verify all measurements at the building and acquaint themselves with the existing conditions before submitting their bid proposal.
 - 3. Examined all architectural, structural, mechanical and other applicable drawings.
 - 4. Become familiar with the electrical drawings and specifications.
 - 5. Developed an understanding of the electrical system requirements.
 - 6. Discussed the project with the Electrical System Installer and determine that he can successfully execute the electrical work.
 - 7. Accepted such conditions and included allowances for them in their bid.

1.7 ELECTRICAL COST BREAKDOWN

- A. Refer to Division 01.
- B. The Contractor shall furnish to the Owner's Representative a breakdown of the electrical construction cost within thirty (30) days of notice to proceed. The breakdown shall be in general conformance with the following:
 - 1. Bonds, Permits, Fees
 - 2. Cartage, Rentals, Shack
 - 3. Supervision
 - 4. Demolition
 - 5. Feeder Conduit and Wire
 - 6. Feeder Labor
 - 7. Branch Circuit Conduit and Wire
 - 8. Branch Circuit Labor
 - 9. Devices and Plates
 - 10. Trim Labor
 - 11. Panelboard(s)
 - 12. Disconnects and Miscellaneous Materials
 - 13. Equipment Connection Labor

1.8 PAYMENT REQUESTS

- A. Refer to Section Division 01.
- B. Payment requests for materials and equipment will not be reviewed or approved until shop drawings have been received and approved.

1.9 GUARANTEE

- A. The electrical equipment and installation shall be guaranteed for a period of one (1) year from date of acceptance unless an individual item or specification is otherwise noted as longer. The Contractor shall make good at their own expense all defects in their work, and/or equipment furnished by them, which shall develop at any time during the one year guarantee period and shall stand any expense of cutting and patching and repairing made necessary by their corrections of unsatisfactory work or equipment operation.

1.10 ALTERNATES

- A. See Division 01 for a list of alternates to bid for this project. Contractor shall include cost of their bid for complete working electrical system as described in the alternates and shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials used under this Contract, unless specifically noted otherwise shall be delivered to the site new, in their original unbroken packages and shall be of the best quality of their respective kind and shall conform to the latest Standard Specifications of the American Society for Testing Materials, National Electrical Manufacturers' Association, National Board of Fire Underwriters or other appropriate agency. Standard items shall bear the stamp indicating listing by Underwriter's Laboratories, Inc. when such listing is available. Custom-designed items shall be fabricated of UL approved materials.
- B. Throughout these specifications various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type or catalog number. Such designations are to establish standards of desired quality and construction and shall be the basis of the bid.

- C. Substitutions will be allowed only as herein provided. No substitutions will be permitted without the Architect's written acceptance. Refer to Division 01 of these specifications for additional requirements.
 - 1. All prior acceptance submittals shall be accompanied by a transmittal letter indicating date, project name, product description/type, and deviations from contract documents if any.
 - 2. Present complete photometric data as listed by an independent testing laboratory for all proposed luminaire substitutions. See additional requirements in Section 26 50 00.
 - 3. Subject to the Architect's discretions certain items may be considered for substitution only after samples have been submitted for review.
- D. Contractors wishing to bid on equipment other than that listed shall obtain prior acceptance of same. Unless prior acceptance (By Addendum) is issued to all bidders, the Contractor will be held to furnish all items exactly as scheduled and/or specified.
- E. Unauthorized product substitution will be removed from the job site and replaced with the specified item at the Contractor's expense.

2.2 EQUIPMENT/MATERIAL SUBSTITUTIONS

- A. Throughout these specifications and drawings, various materials, equipment, apparatus, etc., are specified or scheduled by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of design and the bid.
- B. Substitutions will not be permitted without written approval
- C. Where two or more manufacturer designations are listed in these specifications, choice will be optional with the Contractor except that where more than one manufacturer is listed, and only one manufacturer's catalog number is specified or only one manufacturer scheduled on the drawings (basis of design) that standard of quality, dimensional characteristics, capacities, and construction shall be maintained by materials or equipment supplied by the other manufacturer(s).
- D. If the Division 26 Contractor uses manufacturers other than the basis of design, the Contractor shall be responsible for:
 - 1. Insuring the substituted item will fit the available space while allowing proper maintenance access.
 - 2. Any changes required by other Contractors caused by the substituted equipment.
- E. In the event other than specified equipment is used and will not fit job site conditions, this Contractor assumes responsibility for replacement with items indicated as the basis of design.

2.3 OWNER FURNISHED EQUIPMENT AND MATERIALS

- A. The Contractor shall accept and become responsible for all Owner furnished equipment and materials. Inspect all equipment and materials to determine suitability for installation. Immediately notify the Owner of any defects or deficiencies. Failure to so notify the Owner shall mean that the Contractor warrants that all equipment and materials are of the proper quantity, design and are free from all defects. Properly store all equipment and materials.

2.4 SUBMITTALS FOR REVIEW

- A. Shop Drawings
 - 1. Refer to Division 01.
 - 2. Shop drawings, catalog information and material schedules shall be submitted for approval on all materials and equipment prior to ordering. This applies to all specified material and equipment in Division 26.
 - 3. Provide specific wiring diagrams for all equipment requiring electrical or control wiring. Upon approval, copies of these diagrams shall be forwarded to pertinent contractors.
 - 4. Shop drawing submittal shall be the same size as the contract documents and shall show the floorplan scaled at 1/8 inch = 1 foot. Shop drawing shall be generated using a computer aided

drafting program; as-built .DWG drawings shall be delivered to the Architect.. CAD floorplans of the contract documents will be provided by the Owner's representative upon completion of an "Consent for the Release of Electronic Files" (forwarded by the Owner's representative on request).

- B. Electronic PDF submittals will be accepted for review. Provide Electronic bookmarks for each individual spec section submitted.
- C. Furnish complete shop drawing/catalog data for equipment and materials to be used in the work for review. Allow sufficient time for developing shop drawings, processing and review time so that the installation will not be delayed.
- D. Shop drawings shall be reviewed, approved and stamped by Contractor prior to submitting to Owner's Representative for approval. Submittals without such approval will be returned without review.
- E. Where choices of options and accessories are available or specified, provide written description of what is to be furnished. If necessary, list page numbers where submitted items are described.
- F. Underline applicable data.
- G. If material or equipment is not as specified or submittal is not complete, it will be rejected. Only complete submittal including all applicable specification sections will be reviewed.
- H. Catalog data or shop drawings for equipment that are noted as being reviewed shall not supersede Contract Documents.
- I. Review comments shall not relieve Contractor from responsibility for deviations from Contract Documents unless attention has been called to such deviations in writing at time of submission, nor shall they relieve this Contractor from responsibility for errors in items submitted.
- J. Check work described by catalog data with Contract Documents for deviations and errors.
- K. Hard copies and Electronic PDF shall be provided for final copy. Final hard copy submittals shall be bound in a black 3-ring binder with the project name on the cover. Provide index tabs for each specification section in same order and using same name as appears in the Specifications. Submit data in accordance with Division 01 and in accordance with this section. Data shall be black and white, on 8½×11 inch or 11×17 inch, single, one-sided sheets suitable for copying. Diagrams and drawings larger than 8½×11inch shall be accordion folded to fit in a three ring binder. Drawings and catalog data must be clean, neat copies. FAX material or other poor quality copies will not be acceptable.
- L. Submit four (4) copies of each shop drawing. The Engineer will retain one stamped copy, one will be provided to the Architect and a two stamped and reviewed copies will be returned to the Contractor. The Contractor shall be responsible for distribution of required number of reviewed copies to parties other than the Owner's Representative(s).

PART 3 - EXECUTION

3.1 GENERAL

- A. Workmanship shall be of first quality throughout and shall be in complete accordance with the applicable codes.

3.2 SCHEDULING

- A. This Contractor is advised that the work on this project is phased to suit the requirements of the Owner. During construction, it may be necessary to make temporary connections or installations to accommodate the phased nature of the work. Some work may need to be installed and then reinstalled in order to satisfy the operational requirements of the Owner. Power changeover for existing loads shall be made in the smallest possible increments with branch circuit by branch circuit re-connection required wherever possible.

- B. The controlling issue governing the work described under Division 26 shall be:
DE-ENERGIZING OF ANY FEEDER, SWITCHBOARD, PANEL, BRANCH CIRCUIT OR OTHER EXISTING ELECTRICAL DEVICE OR ITEM SHALL BE AFFECTED ONLY AFTER NOTIFICATION AND SCHEDULING WITH THE OWNER'S PROJECT COORDINATOR.
- C. The Contractor shall prepare written proposed schedules for all systems, feeders, panels and branch circuits to be de-energized and submit same to the Owner's Project Coordinator fourteen (14) days in advance of the first schedule item for acceptance. Schedules shall include at least the following:
 - 1. Specific load to be de-energized
 - 2. Proposed date and time to be de-energized and re-energized
 - 3. Backup plan should an emergency occur during the outage period (for critical loads)
- D. Schedules proposed by the Contractor are subject to adjustment by the Owner.
- E. The Contractor is advised that the above notification and scheduling requirement may necessitate rescheduling, partial completion and re-connection, overtime work at night or on weekends or delay of the work. Contractor costs incurred due to the above shall be included in the original bid price and shall not be the cause for additional claims or charges to the Owner.

3.3 COORDINATION, INSERTS AND OPENINGS

- A. This installation requires extensive interfacing. It is the responsibility of the Contractor to clarify any questions or discrepancies with the Engineer and to ascertain and verify installation conditions about which he is unsure prior to commencing work. Further, during the entire construction period, coordinate, verify and confirm that related work by other trades is done in a manner that will not complicate or compound the electrical systems work.
- B. Locations of devices, outlets, fixtures, equipment, etc. as shown on the drawings are approximate unless dimensioned. Exact locations of such items shall be determined by the Engineer's representative or secured from special details and drawings. The Contractor shall insure that no switches or other electric control devices are mounted such that they are trapped behind opened doors or otherwise rendered inaccessible.
- C. Obtain rough-in and connection dimensions as required for power, control and grounding connections to equipment items that require electrical connection.
- D. Verify the physical dimensions of each item of electrical equipment to fit the available space and promptly notify the Engineer prior to roughing-in, if conflicts appear. Coordination of equipment to the available space and to the access routes through the construction shall be the Contractor's responsibility.
- E. Provide inserts for hangers, brackets, clamps, etc. as required to support boxes, raceways, cables, fixtures, equipment, etc. Coordinate location and routing to avoid interference with work of other trades. Method of insert placement shall suit the type of construction into which the inserts are to be installed.
- F. Furnish and install sleeves and block-outs required for openings in the structure needed to install the electrical work. The responsibility for proper placement of sleeves and block-outs shall be with the Contractor.
- G. Openings for electrical work shall be carefully caulked or grouted as required. Spare conduits shall be tightly capped.
- H. All roof and exterior wall penetrations shall be flashed and counter-flashed watertight. Caulking shall be equal to General Electric silicone construction sealants.

3.4 CUTTING AND PATCHING

- A. Cutting of concrete or other building materials shall be avoided where possible. The Contractor shall have a workman present at the pouring of concrete and at the building of any masonry that contains electrical work.

- B. All cutting and patching of new and existing construction required for the installation of systems and equipment specified in Division 26 shall be the responsibility of the Division 26 Contractor. All cutting shall be accomplished with masonry saws, drills or similar equipment to provide neat uniform openings.
- C. Patch and repair walls, floors, ceilings, and roof with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials. All patching shall meet the approval of the Owner's Representative.
- D. All cutting and patching made necessary to repair defective equipment, defective workmanship or by neglect of this Contractor to properly anticipate their requirements shall be included in Division 26.
- E. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses or other structural members without the Owner Representative's written approval.
- F. Cutting, patching, repairing, and replacing pavement, sidewalks, roads, and curbs to permit installation of work specified or indicated under this Division is responsibility of Division 26.

3.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. See Section Division 01 for additional requirements.
- B. Follow manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.
- C. Promptly notify Owner's Representative in writing of conflicts between requirements of Contract Documents and manufacturer's directions and obtain written instructions from Owner's Representative before proceeding with work. Contractor shall bear expenses arising from correcting deficiencies of work that do not comply with manufacturer's directions or such written instructions from Owner's Representative.
- D. Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in a dry, heated space.
- E. Notify Owner of equipment delivery dates, twenty-four (24) hours in advance of delivery.
- F. The Contractor shall be responsible for protection of equipment furnished in this Division from vandalism and weather during all phases of construction. Damaged equipment shall be restored to like new condition or replaced at the Contractor's expense.
- G. Any factory painted equipment scratched or marred during shipment or construction shall be restored to original "new" condition. This includes complete repainting if necessary to provide exact paint match.

3.6 PROTECTION AND CLEANING

- A. The Contractor shall provide adequate means for protection and shall fully protect all material and equipment against damage from any causes during the progress of the work and until approval by the Architect.
- B. All material and equipment, both when in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all electrical conductors, buses and connections, electronic components and moving parts shall be kept clean and dry.
- C. All damaged material or equipment, including face plates of panels and switchboard sections, shall be replaced or refinished by the manufacturer at no additional expense to the Owner.
- D. During the progress of the work, the Contractor shall clean up after their workers and shall leave the premises and all portions of the building in which he is working free from their debris.

- E. Provide and maintain suitable barriers, protective devices, lights and warning signs where required for protection of the public and employees about the building and site.

3.7 PAINTING

- A. No painting is included in Division 26 except as specifically called for.
- B. Where exposed electrical raceways and equipment are to be painted, schedule work to insure that such electrical items are installed prior to painting or that items installed afterward are painted later to match the original finishes.
- C. Protect latches on panelboard covers, wiring devices, device faceplates, clocks, and other electrical devices against accidental painting.
- D. Protect nameplates and labels on electrical equipment from being obscured by paint.

3.8 VISITING THE PROJECT SITE

- A. Examine premises and understand the conditions that may affect performance of work of this Division before submitting proposals for this work.
- B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions.

3.9 TESTS

- A. See individual specification sections for Testing Requirements.

END OF SECTION

SECTION 260102
PROJECT FINALIZATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Operation and Maintenance Manual
- B. Operation and Maintenance Training/Startup
- C. Spare Parts/Maintenance Materials
- D. Warranties
- E. Final Cleaning
- F. Record Drawings
- G. Punch List Procedures
- H. Maintenance Services

1.2 RELATED SECTIONS

- A. Refer to Section Division 01 - Contract Closeout
- B. Section 26 01 01 - Basic Electrical Requirements

1.3 OPERATION AND MAINTENANCE MANUAL

- A. Bind Operation and Maintenance Manual for Electrical Systems in a black three-post, hard-backed binder. Cover to include job title, date, Engineer, Architect and Contractor names.
 - 1. Provide a master index at the beginning of Manual showing items included. Use plastic index tabs for end section of the Manual.
 - 2. First section shall consist of name, address, and phone number of Architect, Mechanical and Electrical Engineers, General Contractor, and Electrical Contractors.
 - 3. Provide a separate section for each section of the specifications. Provide index for each section listing equipment included.
- B. Product literature, catalog cuts, etc. shall be clean copies. FAX or other poor quality prints will not be acceptable.
- C. Submit one (1) copy of Operation and Maintenance Manual to Owner's Representative for review. After this review and final approval of the manuals, prepare two (2) copies of approved manuals for use during the instruction period. Following instruction period, turn over both copies to the Owner.
- D. In general, the following shall be included in the Operation and Maintenance Manual for each electrical equipment item:
 - 1. List of electrical equipment used indicating name, model, serial number, and name plate data of each item together with number and name associated with each system item as indicated on the drawings.
 - 2. Manufacturer's maintenance instructions: Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
 - 3. Step-by-step procedure to follow in putting each piece of electrical equipment into operation
 - 4. Wiring diagram for particular equipment item
 - 5. Refer to individual specification sections for additional information required to be incorporated into the Operation and Maintenance Manual.
- E. Include the following additional items in the O&M Manual:

1. Summary list of spare equipment parts furnished under this contract
2. Test Records of feeders, transformers, circuit breakers, telephone/data wiring, etc.
3. Signed checklist of Instruction Period
4. Copies of specific product Warranties.
5. Electrical identification schedules
6. Copies of manual describing specific maintenance services that will be furnished

1.4 OPERATION AND MAINTENANCE TRAINING/STARTUP

- A. Upon completion of the work, the Contractor shall assemble the Electrical Systems Installer and any subcontractors together with factory representatives for system start-up and demonstration. These people shall assist in start-up and check out each system and remain at the site until the total electrical system operation is acceptable and understood by the Owner's designated maintenance and/or operation personnel. The Electrical System Installer or a subcontractor or factory representative designated by them shall also give personal instructions on operation and maintenance of the electrical equipment to the Owner's maintenance and/or operation personnel.
- B. To prove acceptance of operation and instruction by the Owner's representative, the Contractor shall prepare a written statement of approval detailing it for their signature. The statement shall read as follows:

"I, the Contractor, together with the Electrical Systems Installer and the associated factory representatives, have started each system and the total electrical system, and have demonstrated their normal operation to the Owner's representative and have instructed them in the operation and maintenance thereof."

Owner's Representative

Contractor

Electrical System	Demonstrated By/Witnessed By	Instruction Time Allotment	Date
Demonstrate Operation and Instruct Owner in Maintenance of General Electrical System	/	2.0 hrs	
Written Guarantee Received	/		
O&M Manuals Received	/		
As-Built Drawings Received	/		

1.5 SPARE PARTS/MAINTENANCE MATERIALS

- A. Provide summarized list of spare parts that are to be furnished. Incorporate into O&M Manual.
- B. Refer to individual specification sections for spare parts to be furnished under this contract.
- C. Turn spare parts and materials over to Owner.

1.6 WARRANTIES/GUARANTEES

- A. The Contractor shall guarantee all work to be free from defects in material and workmanship for a period of one (1) year. See General Conditions for beginning of guarantee period. The Contractor shall make good at their own expense all defects in their work and/or equipment furnished by them, which shall develop at any time during the one (1) year guarantee period and shall stand any expense of cutting and patching and repairing made necessary to correct unsatisfactory work or equipment operation.
- B. Exceptions - incandescent lamps shall be guaranteed for a period of one month.

- C. Manufacturer's warrantee certificates shall be included in the Operation & Maintenance Manuals for equipment that is warranted by the manufacturer for a period greater than one year.

1.7 CLEAN-UP

- A. Clean up all equipment, materials, cartons and other debris that is a direct result of the installation of equipment under this contract.
- B. Clean exposed conduits, equipment, and fixtures. Repair damaged finishes and leave everything in working order.
- C. Remove stickers from fixtures and electrical equipment.

1.8 RECORD DRAWINGS

- A. Record differences, between electrical work as installed and as shown in Contract Documents, on a set of prints of electrical drawings to be furnished by Owner's Representative. Return these prints to Owner's Representative at completion of Project. Notations made on drawings shall be neat and legible. These drawings shall not be used for any other purposes.
- B. Refer to individual specification sections for additional requirements.

1.9 PUNCH LIST PROCEDURES

- A. The Contractor shall notify the Owner's Representative in writing when the project is ready for punch lists. After punch lists are complete, written notice must be forwarded to the Owner's Representative requesting final checkout. Any additional trips by the Engineer to the site for punch list verification that become necessary due to items on previous punch lists that have not been completed at the time of the final checkout will be billed to the Contractor at normal rate plus travel expenses.
- B. At the time of punch list and final project checkout, the project foreman shall accompany the Engineer and remove coverplates, panel covers and other access panels to allow complete review of the entire electrical systems.

1.10 MAINTENANCE SERVICES

- A. Provide separate manual describing specific maintenance services to be provided as required under specific specification sections.

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SECTION 260160
ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Phased remodel construction in existing occupied buildings
- B. Additions to existing occupied buildings
- C. Asbestos control within existing buildings
- D. Demolition and salvage within existing buildings

1.2 RELATED SECTIONS

- A. Reference Section 26 01 01
- B. Division 01 - Alteration Project Procedures
- C. Division 02 - Minor Demolition for Remodeling

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as shown on drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to the Architect/Engineer before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

- A. Coordinate service outages with serving company.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- C. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Reference Section 26 01 01 - Scheduling. Make temporary connections to maintain service in areas adjacent to work area.
- D. Existing Fire Alarm System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Reference Section 26 01 01 - Scheduling. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Reference Section

26 01 01 - Scheduling. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION OF EXISTING ELECTRICAL WORK

- A. Remove existing electrical equipment including switchgear, panels, and disconnect devices, conduit and wiring, unless specifically indicated to remain. Completely remove such equipment from the site and properly dispose of it, unless specifically instructed otherwise.
- B. Remove conduit as required to accommodate work of other trades. Remaining existing branch circuit may be reused to the extent possible.
- C. Remove inactive and abandoned raceways except raceways embedded in floors and walls, and raceways completely concealed above ceilings, may remain as long as such materials do not interfere with new installations.
- D. Remove inactive and abandoned wire; including disconnected circuits and circuits from which all terminal devices or loads have been eliminated.
- E. All openings left in existing construction by removal of existing equipment shall be patched and finished to match existing finishes.
- F. If during demolition, existing active services are encountered they shall be relocated as required to accommodate the remodeling. The continuity of said services shall be maintained at all times, except as provided under Section 26 01 01 - Scheduling.

3.4 RELOCATION OF EXISTING EQUIPMENT

- A. Relocate existing electrical equipment as indicated on the drawings. Equipment to be relocated shall be serviced and repaired as necessary to place in good working order and to the satisfaction of the Architect/Engineer. Relocated equipment shall be disconnected and completely reconnected to required services at new location.
- B. Cap off and abandon or remove existing services as required where existing equipment is disconnected or removed.

3.5 POTENTIAL ASBESTOS HAZARD

- A. Specific attention is directed to the probability of the existence of asbestos bearing compounds and/or materials at the project site. Careful coordination with other workers and reasonable care should be exercised, in accordance with OSHA Regulations on Asbestos #1910.1001, until a definitive statement concerning the existence of asbestos and the safety of or hazard to workers in the area is made by a testing agency licensed and certified to perform such tests.
- B. Should such a definitive statement include the possibility or probability of health risk to workers, this contractor shall immediately remove themselves and all workers in their employ or under their control from the area until resolution of the hazard is satisfactorily achieved.

3.6 PCB CONTAINING DEVICES

- A. It shall be assumed that all existing ballasts at this site were manufactured prior to 1978 and contain polychlorinated biphenyls (PCBs). Ballasts with labels that do not contain the statement "No PCBs" shall be disposed of in accordance with the requirements of Federal Regulation 40, CFR Part 761.

3.7 EXISTING UTILITIES AND PIPING

- A. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a 10 foot radius of the indicated location. Where connection points are not within this radius, the Contractor shall contact the Owner's Representative for a decision before proceeding or may proceed at their own expense.

- B. Connection points to existing work shall be located and verified prior to starting new work.

3.8 CUTTING AND PATCHING

- A. Reference paragraph 26 01 01 3.4 Cutting and Patching.

END OF SECTION

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SECTION 260519
BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Building wire and cable
- B. Service entrance cable
- C. Metal-Clad cable
- D. Wiring connectors and connections

1.2 RELATED SECTIONS

- A. Section 26 05 53 - Electrical Identification

1.3 REFERENCES

- A. NECA Standard of Installation (National Electrical Contractors Association)
- B. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association)
- C. NFPA 70 - National Electrical Code

1.4 SUBMITTALS FOR REVIEW

- A. Product Data: Submit information covering every type of wire or cable to be provided on the project.

1.5 PROJECT CONDITIONS

- A. Verify that field measurements are as indicated.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing indicated is approximate unless dimensioned.

1.6 COORDINATION

- A. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers: Conductors shall be as manufactured by:
 - 1. American Insulated
 - 2. Cerro
 - 3. Encore
 - 4. Essex
 - 5. Houston
 - 6. Southwire
- B. Wire and cable shall be copper single conductor type with 600 volt insulation, unless otherwise indicated.
- C. Copper conductors shall be soft drawn, minimum 98% conductivity.

- D. Grounding conductors shall be copper in all cases, no exceptions.
- E. #12 and smaller wire shall be solid with type TW, THW or THWN insulation. Larger wire shall be stranded with type THW or THWN insulation.
- F. Outer jackets of conductors shall be color coded as follows:
 - 1. 120/208 volt circuits.
 - a. Phase A-Black
 - b. Phase B-Red
 - c. Phase C-Blue
 - d. Neutral-White
 - 2. 277/480 volt circuits
 - a. Phase A-Brown
 - b. Phase B-Orange
 - c. Phase C-Yellow
 - d. Neutral-Gray
 - 3. Insulated ground wires-Green.
 - 4. On large conductors, for which color coded jackets are not available, install bands of adhesive non-fading colored tape or slip-on bands of colored plastic tubing over the cables and wires at their terminations and in the vaults, wireways, junction boxes and outlet boxes. In vaults and wireways, install the color coding at each end of the wireway and at approximately 3 foot intervals within the vault or wireway.
 - 5.
 - 6. Materials used for identification shall be colorfast and shall withstand cleaning. Colors used shall be the same as specified for outer jackets.

2.2 METAL-CLAD CABLE

- A. Manufacturers: Metal-clad cable shall be equal to AFC Catalog #MC-TUFF as manufactured by AFC/A Monogram Co.
- B. Metal-clad cable shall be Type MC pre-manufactured cable assemblies consisting of color-coded phase, neutral and ground conductors bound together with an outer covering of interlocked armor.
- C. Metal-clad cable shall be two-hour fire rated.
- D. Conductors shall be stranded copper with 600 volt type XHHW or THHN insulation. Insulation shall be color-coded as specified above for wire. Conductors shall be no smaller than #12 AWG.
- E. Core binder shall be polyester tape. Fillers, if included, shall be non-hydroscopic and non-wicking.
- F. Each metal-clad cable shall be provided with an insulated ground conductor together with the phase and neutral conductors enclosed within the armor.
- G. Fittings for metal-clad cable shall be UL listed as suitable for grounding Type MC cable armor.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.

3.2 INSTALLATION IN RACEWAYS

- A. Wire and cable shall be run in metal raceways, except where plastic conduit has been specifically approved. Pull all conductors into raceway at same time.

- B. Branch circuit runs are shown schematically. Except where exact routing is indicated, branch circuit home runs may be grouped and the actual routing of branch circuit conduits may be determined at the site and properly entered on the As-built drawings.
- C. Provide dedicated neutrals for all multi-wire branch circuits
- D. Use solid conductor for feeders and branch circuits 12 AWG and smaller.
- E. Use stranded conductors for control circuits.
- F. Use conductor not smaller than 12 AWG for power and lighting circuits.
- G. Use conductor not smaller than 14 AWG for signal and control circuits, except as indicated.
- H. Use 10 AWG conductors for the entire length of the branch circuit for 20 ampere, 120 volt branch circuits longer than 75 feet.
- I. Use 10 AWG conductors for the entire length of the branch circuit for 20 ampere, 277 volt branch circuits longer than 200 feet.
- J. Use minimum 10 AWG conductors for all exterior lighting circuits. 12 AWG conductors shall be permitted for building mounted exterior lighting.
- K. Use suitable wire pulling lubricant for building wire 4 AWG and larger. Verify lubricant is compatible with wire manufacturer's recommendations.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- M. Where more than three current carrying conductors are installed in a single raceway, the minimum wire size shall be increased to provide allowable load current of 100 % of the overcurrent device in accordance with National Electrical Code, Table 310-15(b)(2)(a).
- N. All splices shall be made in properly sized junction/pull boxes.
- O. Service entrance and feeder conductors shall be installed without splices.
- P. Except where sizes are indicated on the drawings, the following schedule shall be adhered to:

Circuit Overcurrent Device Rating	Conductor Sizes
20 amperes or less	#12
25 or 30 amperes	#10
35 or 40 amperes	#8
45 or 50 amperes	#6
60 or 70 amperes	#4
80 or 90 amperes	#2
100 or 110 amperes	#1
125 or 150 amperes	#1/0

- Q. Conductor sizes indicated on drawing are based on anticipated feeder and branch circuit lengths. Contractor shall increase conductor size as required to account for voltage drop based on actual installed circuit length. Voltage drop shall not exceed NEC allowances.
- R. Where ambient temperatures are within 50 °F of the maximum allowable operating temperatures of the insulation of a conductor, provide conductors with insulation of higher temperature rating suitable for the temperature to be encountered.
- S. Identify and color code all wire and cable as specified above. Identify each conductor with its circuit number or other designation indicated.

3.3 WIRING CONNECTIONS AND TERMINATIONS

- A. The use of wire nuts is restricted to splices in wire #8 and smaller and shall be made with Scotchlok or approved equal. Splices made in conductors larger than #8 shall be made with one of the following:

1. Compression type connectors, smoothed out with insulating putty, and thoroughly taped with Scotch #33 or approved equal electrical tape.
 2. Power distribution blocks as made by ILSCO or approved equal.
- B. Clean conductor surfaces before installing lugs and connectors.
- C. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- D. Re-tighten all bolt type connections twenty-four (24) to forty-eight (48) hours after installation and before taping. All bolt type connections to bus-bars shall employ spring loaded Belleville washers.
- E. All cables shall extend between outlets with complete electrical continuity and without any shorts or grounds. Cables shall be uninterrupted and unspliced.
- F. Cables shall be routed so as to maintain a separation of at least 2 feet from all heat sources and from ballasts, transformers, dimmers and all other sources of electromagnetic interference. Avoid cables in areas where they may be damaged as a result of normal use of the area.
- G. Cable run in ceiling cavities shall not lie upon the ceiling or be supported from ceiling suspension wires or from conduits or pipes, but shall be suspended from the building structural elements using cable ties.
- H. Care shall be exercised during installation not to damage the cable insulation. Damaged cables shall be removed and replaced.
- I. Stranded conductors shall not be connected directly to wiring devices. Where such connections are to be made, insulated solid copper wire "tails" shall be spliced to the stranded conductors in the outlet box.

3.4 METAL-CLAD CABLE INSTALLATION

- A. Metal-clad cable may be utilized for :
1. Lighting fixture whips not exceeding 6 feet in length. Daisy chaining of lighting fixtures is not permitted. Provide a dedicated fixture whip from each fixture to nearest j-box.
- B. Metal-clad cable shall incorporate the correct mix of phase, neutral and ground conductors, properly color coded as specified in Part 2 - above.
- C. It is not permissible to separate any phase conductor from the associated conductor that serves as its current return path. Where these requirements cannot be fulfilled using metal-clad cable, wire in raceway shall be utilized instead.
- D. In no case shall the size of the phase, neutral or ground conductors be reduced, through the use of metal-clad cables, to sizes less than indicated on the drawings.
- E. Cables shall be routed so as to maintain a separation of at least 2 feet from all heat sources and from ballasts, transformers, dimmers, and all other sources of electromagnetic interference. Avoid cables in areas where they may be damaged as a result of normal use of the area.
- F. Cable run in ceiling cavities shall not lie upon the ceiling or be supported from ceiling suspension wires or from conduits or pipes, but shall be suspended from the building structural elements using cable ties.
- G. Care shall be exercised during installation not to damage the cable insulation. Damaged cables shall be removed and replaced.

END OF SECTION

SECTION 260520
EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical connections to equipment

1.2 RELATED SECTIONS

- A. Section 26 05 19 - Building Wire and Cable
- B. Section 26 05 30 - Conduit
- C. Section 26 05 32 - Boxes

1.3 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices
- B. NEMA WD 6 - Wiring Devices - Dimensional Requirements
- C. NFPA 70 - National Electrical Code

1.4 SUBMITTALS FOR REVIEW

- A. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.6 COORDINATION

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

- A. Manufacturers: Leviton, Bryant, Hubbell, Pass & Seymour, and Arrow-Hart.
- B. Attachment Plug Construction: Conform to NEMA WD 1.
- C. Configuration: NEMA WD 6, UL 498, heavy duty nylon construction with external cord clamp and dead-front construction, with rating and NEMA configuration molded on the device. Match receptacle configuration at outlet provided for equipment.
- D. Cord Construction: NFPA 70, Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

- E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Provide final connection of all equipment items as scheduled. Coordinate work with the equipment supplier/installer.
- K. Obtain dimensioned shop drawings from the equipment suppliers prior to rough-in of branch circuits.
- L. Where equipment requires a cord connection, install a new cord and cap if the one furnished does not match the receptacle provided.
- M. Circuit breaker, feeder and fuse sizes shall be coordinated with the nameplate data on the equipment actually furnished.
- N. Install motor starters and provide power wiring to motors and controls. Verify that starters include an overload device for each ungrounded conductor and a single, common reset button.
- O. Provide disconnecting safety switches for all mechanical equipment and for permanently connected motors larger than 1/8 Hp unless the connected equipment is complete with an approved disconnecting means, or is adjacent to another approved means of disconnect for the circuit. Disconnection devices shall be fused safety switches except where manual motor starters or toggle switches are indicated on the plans. Provide fused safety switches with the appropriate type and size of fuses.
- P. Interlock all disconnects installed between VFD's and motors with the VFD. Provide relays and contacts as required.
- Q. Motor and starter wiring shall be done in complete accordance with wiring diagrams provided by the supplier.
- R. Check the rotation of all three phase motors and reconnect same where necessary to provide the proper direction of rotation as required for the driven unit. Check all motor starters for properly sized overload relays and properly sized heaters.

- S. Where indicated on the electrical drawings, provide control and interlock wiring on schedules for motor control centers or separate electrical motor controllers, or elsewhere in the Division 26 of the specifications for electrically-powered equipment.
- T. Provide all required relays, wiring and equipment required for fire alarm fan shutdown. Interconnecting controls shall be rated to match starter control voltage.
- U. Receptacles and outlet boxes for electric water coolers shall be concealed within the water cooler enclosure.

3.3 FIRE/SMOKE DAMPER WIRING

- A. Provide a circuit for each fire/smoke damper. Refer to mechanical drawings for locations.
- B. Provide a toggle switch suitable for use as a disconnect at each fire/smoke damper location.
- C. Provide connection to each fire/smoke damper as required for control of damper. Refer to plans for additional information.

END OF SECTION

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SECTION 260526
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Equipment grounding conductors
- B. Bonding

1.2 REFERENCES

- A. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association)
- B. NFPA 70 - National Electrical Code

1.3 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 10 ohms

1.4 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Section 26 01 01.
- B. Product Data: Provide data for grounding electrodes and connections, installation details, dimensioned plan view drawings of the buildings showing the grounding system, and criteria for system test and acceptance. As a minimum, said drawings shall show the type and location of all conductors, fasteners, splices and connectors, and all ground terminals. Submittal shall include design criteria and calculations for any deviations from these specifications.

1.5 PROJECT FINALIZATION

- A. Submit under provisions of Section 26 01 02.
- B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- C. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with the manufacturer

1.6 OPERATION AND MAINTENANCE DATA

- A. Division 01 - Contract Closeout: Operation and Maintenance Data: Warranties: Procedures for submittals
- B. Project Record Documents: Record actual locations of components and grounding electrodes.
- C. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.7 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Product: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MECHANICAL CONNECTORS

- A. Materials: Fasteners, splices and connectors shall be specifically selected for the materials to be joined.
- B. Manufacturers:
 - 1. Thompson Lightning Protection, Inc.
 - 2. Burndy Hyground System

2.2 WIRE

- A. Material: Stranded copper
- B. System grounding electrode conductors and bonding conductors shall be stranded single conductors, with 600 volt insulation, sized to meet NFPA 70 requirements, as manufactured by General Cable, Rome, Southwire or Triangle.
- C. Bonding conductors, shall be cabled assemblies of 14 strands of 17 AWG copper wire assembled in a braided smooth twist resulting in ¼ inch diameter cable of 28,500 circular mil cross-sections with a net weight of 92 pounds per 1000 linear feet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 GENERAL

- A. Grounding conductors shall be copper in all cases - no exceptions.

3.3 DISTRIBUTION GROUNDING

- A. Provide grounding electrodes and grounding electrode conductors for separately-derived electrical systems, including dry-type transformers. Ground the neutral of each separately-derived electrical system. Bond the grounding electrodes for each separately-derived system to the premises grounding electrode system.
- B. Use the green insulated equipment grounding conductor of code size installed in the conduit system for equipment and enclosure bonding. If conduits require an increase in size to accommodate this conductor, the entire run shall likewise be increased in size.
- C. Where a conduit enters the enclosure of a switchboard, motor control center or transformer from below, provide an insulated-throat grounding bushing on the conduit and a bonding jumper connecting it to the ground bus and metal frame of the equipment.
- D. Where a conduit enters a painted sheet metal enclosure, the paint shall be cleaned from the area around the locknut to allow metal-to-metal contact or a grounding locknut shall be used.
- E. Provide a redundant equipment grounding conductor together with each feeder run in addition to the conduit system grounding path.
- F. Provide a redundant equipment grounding conductor, in addition to the conduit system ground path and in addition to the phase and neutral conductors shown on the plans, in each branch circuit conduit which supplies receptacles, lights or fixed electrical equipment. An additional isolated ground conductor shall be provided where so indicated on the drawings.
- G. Provide a copper equipment grounding terminal bar in all panelboards, new or existing, where equipment grounding conductors terminate, bonded to a grounding bushing on the conduit feeding the panelboard.

- H. Provide separate grounding conductors at motor connections, transformer connections, and where flexible or non-metallic conduit is used.
- I. Connect the ground terminal on each receptacle to the metallic raceway system with a bonding jumper, except in the case of surge-suppression or isolated-ground type receptacles. The ground terminal of surge-suppression or isolated-ground type receptacles shall be connected to an insulated equipment grounding conductor run with the branch circuit conductors, but isolated from the conduit system except at the panelboard, where it shall be connected to the panelboard ground bus. Maintain continuity of the ground to every outlet in the system.
- J. Metal frames in rooms likely to accumulate water on the floor shall be bonded to the electrical system ground with a green insulated #10 AWG (minimum) grounding conductor, routed in conduit and bonded to the conduit at each end.

3.4 SPECIAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

- A. The AC power circuit to the central equipment for each communications system shall be run in steel conduit and shall include a No.10 AWG insulated copper ground conductor which shall run, to the ground bus in the panelboard that serves the communications system. This ground conductor shall serve as the communications system ground.
- B. Conduits for communications cable shall be steel conduit which shall maintain electrical continuity throughout the conduit run. Conduits shall be grounded to the power system ground and shall be provided with insulated bushings at the entry to the central equipment cabinet to maintain the integrity of the communications system ground.
- C. Grounding of shields for shielded cables shall occur only at the central equipment inputs or outputs of power amplifier. Non-grounded ends shall be terminated with wedge-on collars. Care shall be taken to preserve continuity of shields at all connection points.

3.5 DOCUMENTATION

- A. At the completion of the project, drawings shall be updated to as-built status and incorporated in the project Operation and Maintenance Manuals.

3.6 TESTING

- A. After installation, the newly installed and modified grounding electrode systems shall be tested for system conductivity and ground terminal resistance-to-earth.
- B. A copy of the ground test report shall be included in the Operation and Maintenance Manual.

END OF SECTION

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SECTION 260530

CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal conduit
- B. Flexible metal conduit
- C. Liquidtight flexible metal conduit
- D. Electrical metallic tubing
- E. Rigid plastic conduit
- F. Fittings and conduit bodies

1.2 RELATED SECTIONS

- A. Division 07 - Fire Stopping
- B. Section 26 05 26 - Grounding and Bonding
- C. Section 26 05 32 - Boxes
- D. Section 26 05 53 - Electrical Identification
- E. Section 26 27 27 - Supporting Devices
- F. Section 27 05 28 - Telecommunication Service, Pathways, and Wiring

1.3 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated
- C. ANSI C80.5 - Rigid Aluminum Conduit
- D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
- E. ANSI/NFPA 70 - National Electrical Code
- F. NECA "Standard of Installation"
- G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
- H. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
- I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing

1.4 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70

1.5 SUBMITTALS

- A. Product Data: Provide data for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, conduit bodies, hangers for raceways and fire sealants.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Accurately record actual routing of conduits larger than 1 inch.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site under provisions of Section 26 01 01.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete the wiring system.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube and Conduit
 - 2. LTV
 - 3. Republic Conduit
 - 4. Western Tube and Conduit
 - 5. Or equal
- B. Rigid Steel Conduit: ANSI C80.1
- C. Intermediate Metal Conduit (IMC): Rigid steel
- D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; Threaded galvanized or cadmium plated steel fittings. Bushings shall have nylon insulated throats.

2.2 FLEXIBLE METAL CONDUIT

- A. Manufacturers: AFC, Anamet, Triangle PWC, or equal
- B. Description: Interlocked, galvanized steel construction
- C. Fittings: ANSI/NEMA FB 1: Specifically designed for the purpose. Malleable iron or steel. Shall be similar to Thomas and Betts 'Super-Tight'.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers: AFC, Anamet, Electriflex, Alflex, or equal
- B. Description: Interlocked, galvanized steel construction with PVC jacket.
- C. Fittings: ANSI/NEMA FB 1: Specifically designed for the purpose. Shall be similar to Thomas and Betts 'Super-Tight'.

2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube and Conduit

2. LTV
3. Western Tube and Conduit
4. Wheatland Tube
5. Or equal

- B. Description: ANSI C80.3; galvanized tubing
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel, compression type with nylon insulated throats on connectors.

2.5 RIGID PLASTIC CONDUIT

- A. Manufacturers: Carlon, PW Pipe, Triangle PWC, or equal
- B. Description: NEMA TC 2; Schedule 40 PVC. Type EB shall be permitted where installed underground in rebar reinforced concrete duct banks.
- C. Fittings and Conduit Bodies: NEMA TC 3, elbows shall be steel.

2.6 CONDUIT WITH INNERDUCTS

- A. Manufacturers: Carlon, Optic-Gard/PE, No 13109, or approved equal
- B. Description: NEMA TC 2
- C. Fittings and Conduit Bodies: NEMA TC 3

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Primary service and secondary service entrance conduit types shall be any combination of the following:
1. Rigid metal conduit for exposed, concealed, underground or underslab runs.
 2. Rigid nonmetallic conduit with a separate ground wire for underground, or underslab on grade, runs.
- B. Feeder conduit types shall be as follows:
1. Rigid metal conduit for exposed, underground or underslab runs.
 2. Intermediate metal conduit in walls, above ceilings, in poured concrete or in masonry, except for runs in hazardous locations.
 3. Electrical metallic tubing with separate ground wire in non-masonry/concrete walls or above ceilings, except for runs in hazardous locations.
 4. Rigid nonmetallic conduit with a separate ground wire for underground or under slab on grade runs, except runs in hazardous locations.
- C. Branch circuit conduit types shall be as follows:
1. Rigid metal conduit for exposed runs up to 4 feet 6 inches above the finished floor in sheltered spaces, for all exposed runs subject to the weather, for runs in hazardous locations and for underground or underslab runs.
 2. Intermediate metal conduit in walls, above ceilings, in poured concrete or in masonry, except runs in hazardous locations.
 3. Electrical metallic tubing in non-masonry/concrete walls or above ceilings, and for exposed runs more than 4 feet 6 inches above the finished floor in sheltered spaces, except runs in hazardous locations.
 4. Liquid-tight flexible steel conduit for connections to transformers, motors and other vibrating equipment in damp and wet areas or where exposed to the weather.
 5. Flexible steel conduit for connections to transformers, motors and other vibrating equipment in dry, sheltered areas.
 6. Rigid nonmetallic conduit with a separate ground wire for underground or under slab on grade runs.

7. Type MC cable where permitted by Section 26 05 19.
- D. Conduits shall be sized in accordance with the applicable codes except where larger conduits are called for on drawings. Sizes shown on the drawings are based on the use of rigid metal conduit and copper conductors with THW insulation unless noted otherwise.
- E. Do not install conduit in poured concrete or masonry walls or slabs without the Architect's approval.
- F. All conduit penetrations of structural elements or conduits run within masonry walls or slabs shall be approved by the Architect in advance of installation.
- G. Conduits run in masonry shall be placed at least 1 inch from the surface. Care shall be taken to avoid placing conduits where they will be subjected to excessive heat.
- H. Conduit ends shall be capped using standard capped bushings or steel "pennies" and bushings to prevent entrance of foreign materials during construction.
- I. Rigid conduit and IMC shall be reamed after threads are cut. Joints shall be cut square and shall butt solidly into couplings. Running threads will not be permitted. Cut ends of EMT shall also be reamed.
- J. Bends in rigid conduit, IMC and EMT runs larger than 1¼ inch shall be of factory-made elbows unless otherwise specifically approved. Bends in 1¼ inch and 1 inch runs shall be made in an approved bending machine (or factory made). Hickey bends will not be permitted in conduits larger than ¾ inch. Bends shall not show flattening.
- K. The radius of the inner edge curve of any field bend shall not be less than indicated in the following table:

Conduit Size (inches)	Inside Radius (inches)
¾	5
1	6
1¼	8
1½	10
2	12
2½	15
3	18
3½	21
4	24

- L. Where conduit runs are 100 feet or longer or contain the equivalent of four (4) 90 degrees bends, pull/junction boxes shall be provided. Pull box locations shall be indicated on the as-built drawings.
- M. Provide a polyethylene pull rope rated at 250 pounds (minimum) tensile strength in each conduit left empty for future use.
- N. Conduits containing innerducts shall consist of a four inch PVC Schedule 40 outer conduit (underground) or RGS (above ground or indoors), with three 1¼ inch ribbed polyethylene innerducts. Install all innerducts at once without crushing or kinking.
- O. Ground and bond conduit under provisions of Section 26 05 26.
- P. Identify conduit under provisions of Section 26 05 53.
- Q. Branch circuit runs are shown schematically. Except where exact routing is indicated, branch circuit home runs may be grouped and the actual routing of branch circuit conduits may be determined at the site and properly entered on the As-built drawings.
- R. Daisy-chaining of light fixture circuits shall not be allowed. Provide a complete conduit system and install a junction box adjacent to each light fixture location. Connect fixtures to adjacent junction boxes using approved raceways described in this section.

- S. Minimum conduit size shall be $\frac{3}{4}$ inch.

3.2 RACEWAY INSTALLATION - SPECIAL UNDERGROUND REQUIREMENTS

- A. Underground conduits installed outside the building perimeter shall be minimum $\frac{3}{4}$ inch trade size and shall have a minimum cover of 24 inches. Underground service conduits shall be encased in a minimum 3 inch concrete envelope (all around).
- B. Primary and service entrance conduits shall be buried deeper than 24 inches if required by the power company.
- C. Where PVC conduit is installed beneath concrete slabs on grade, it shall be buried a minimum of 6 inches below top of sub-surface beneath floor slab. Minimum size of PVC used shall be $\frac{3}{4}$ inch.
- D. Transitions from underslab/grade rigid nonmetallic conduit to above slab/grade conduits shall be made with rigid metallic sweeps. Rigid nonmetallic conduit shall not be installed above slab/grade.
- E. Rigid steel conduit shall be used at penetrations through basement exterior walls encase conduits in a minimum 3 inch concrete envelope (all around) for the first 2 feet on the exterior side of the wall.
- F. Make joints liquid and gastight. Ends of all underground conduits shall be sealed after conductors have been installed to prevent breathing and condensation.
- G. All conduits stubbed out for future use underground shall be extended 5 feet clear beyond buildings, foundations, concrete walks, paving, other utilities and the like. Keep such stubouts at least 10 feet clear of future buildings or other permanent installations. Install a 4×4×12 inch (deep) concrete monument with an embedded brass plate at all conduit ends for future location. The brass plate shall indicate the origin of the conduit whose end it marks.
- H. All metallic conduits installed underground shall be painted with two coats of asphaltic compound or wrapped with one half-lapped layer of Hunt's Wrap Process No. 3. Alternate installation: provide PVC coated metallic conduits.
- I. Slope underground conduits to handholes or vaults at three inches per 100 feet. Where impractical, provide a duct drain in the low point of the conduit. The finished grade elevation at the top of underground pull boxes shall be lower than the elevation of the finished floor at the point of stub-up within the building.
- J. Do not cut, notch or drill foundations, footings, retaining walls or other structural elements without the Architect's advance approval in each case.
- K. Flush floor couplings shall consist of a standard galvanized steel coupling with a brass pipe plug installed flush with the floor. The brass plug shall be fitted with a female square or hex depression.

3.3 RACEWAY INSTALLATION - SPECIAL REQUIREMENTS FOR DIVISION 28 WORK

- A. Where "conduit", "raceway", and/or "conduit system" is referred to in this specification it shall be interpreted as follows:
1. Standard weight galvanized rigid steel conduit underground; less than 36 inches above the floor in concrete or masonry walls; and where exposed.
 2. Intermediate metallic conduit higher than 36 inches above the floor in concrete or masonry walls and less than 36 inches above the floor in frame walls.
 3. Electrical metallic tubing above ceilings and higher than 36 inches above the floor in frame walls.
 4. Cable tray shall be used where indicated on the drawings.
NOTE: ONLY METALLIC CONDUIT SHALL BE USED FOR THE DIVISION 28 RACEWAY SYSTEM. PVC CONDUIT WILL NOT BE ALLOWED.
- B. Minimum size of conduit shall be 1 inch.

- C. Reference the Division 28 drawings for special backbox requirements. Provide all necessary backboxes for the installation of Division 28 equipment. Coordinate all backbox requirements with the Division 28 Contractor prior to installation.
- D. The raceway systems, wire and cable required to support the low voltage systems shall be installed in accordance with the following general installation requirements:
 - 1. Provide a nylon pull-line in each unused conduit. The pull-line shall have a tensile strength of 200 pounds for conduit sizes up to 1 inch, 400 pounds for conduit sizes up to 2 inch and 600 pounds for larger sizes.
 - 2. All conduits shall be clearly identified at both ends as to their destination. Where more than one conduit serves the same location, each conduit should be identified with a unique number.
 - 3. Open ends of conduits shall be plugged to prevent the entrance of moisture or foreign material. If moisture or foreign material is found at the time the cables are being installed, promptly and thoroughly clean the conduit before installation of cables.
 - 4. All conduits shall be securely fastened in place and free from burrs, defects, or obstructions that could interfere with installation of cables.
 - 5. All conduit that terminates at a connection backboard (unless otherwise specified on the drawings) shall terminate at the designated backboard either 12 inches above the floor or 12 inches below the ceiling or at the wireway indicated.
 - 6. All conduit shall be reamed. Where the conduit enters pull boxes, cabinets, wireways, or outlets, the conduit shall be secured by locknut(s) and provided with an insulated bushing on the conduit end.
 - 7. All unused conduits shall be marked as noted above and provided with metal blank end discs and a bushing.
 - 8. All underground control and communication conduits shall have a minimum earth cover of 18 inches, except where subjected to vehicular traffic (to include road right-of-way) the minimum cover shall be 30 inches. Control and communications conduit may be buried in the same trench as power, if separated by a minimum of 3 inches of concrete or 12 inches of dirt.
 - 9. All metallic conduits installed underground shall be painted with two (2) coats of asphaltic compound or wrapped with one half-lapped layer of Hunt's Wrap Process No. 3. Alternate installation: Provide PVC coated metallic conduits.
 - 10. All communications outlets shall be installed at the same height above the finish floor as the electrical outlets, unless otherwise specified on the drawings.
 - 11. All outlet boxes shall be the proper dimension to receive the system device to be installed. Provide plaster rings as required. Use of Tiger Box rings is not approved.
- E. Installation of these conduit, raceway, wiring and grounding systems requires extensive interfacing. Coordinate at all times during the planning and installation of this work to assure that the resulting installation is acceptable to the other subcontractors, the General Contractor and the Owner.
- F. Assure that backboxes in concrete and block walls are installed properly. This includes the proper depth relationship between the lip of the backbox and the finished surface of the wall, verification that the plane of the front of the backbox is parallel with the plane of the finished wall and confirmation that the sides of the backbox are vertical.

3.4 RACEWAY INSTALLATION - SPECIAL ABOVE-GROUND REQUIREMENTS

- A. Conduits shall be concealed in the building construction except in electrical rooms, mechanical rooms and where exposed runs are indicated. Exposed conduits shall be run parallel to walls and ceilings and at the ceiling wherever possible.
- B. Conduits, whether exposed or concealed, shall be securely supported and fastened at intervals of nominally every 10 feet and within 36 inches of each outlet, ell, fitting, panel, etc. Suspended conduits shall be supported by metal rings or by trapeze hangers of Unistrut or Kindorf channel and threaded steel rods. Multiple runs of conduit on ceilings and walls shall be mounted on Unistrut or Kindorf channel. Perforated plumber's tape shall not be used. Single runs of exposed

conduit shall be supported with steel pipe straps. Conduit shall not be supported from ducts, plumbing or other piping or from other conduits but only from building structural elements. Reference additional conduit support requirements under provisions of Section 26 27 27.

- C. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints, or wherever conduit may be affected by dissimilar movements of the supporting structure.
- D. Where conduit is exposed to the weather or in wet locations, make joints liquid and gastight. Ends of all such conduits shall be sealed after conductors.
- E. Keep conduit at least 6 inches from hot water or steam pipes and at least 18 inches from the covering on flues and the like.
- F. Do not cut, notch or drill structural framing members for the installation of conduit without the Architect's advance approval in each case.
- G. Rigid steel conduit shall be used at roof penetrations. Where conduits pass through the roof, provide channel supports below the roof spanning the structural elements of the roof and braced to the building structure in at least two (2) directions at right angles to one another. The conduit penetrating the roof shall be secured to the supports at two (2) points below the roof as required to render the portion above the roof rigid.
- H. Where flexible metal conduit is used for equipment connections or other special (approved) situations provide a continuous copper ground conductor sized in accordance with the applicable codes. Liquidtight flexible metal conduit shall be used for all equipment connections in damp and wet areas. Flexible conduit used for connections to vibrating equipment shall be approximately 3 feet long and contain one (1) 90 degree bend.
- I. Install conduits so that there is a minimum of 12 inches of clearance between bottom of conduit and top of removable ceiling tiles.
- J. Conduit connections between outlet boxes located less than 24 inches apart on opposite sides of the same wall shall be made with a loop of flexible conduit, to limit sound transmission. Use only straight connectors.

3.5 RACEWAY INSTALLATION - SPECIAL TELECOMMUNICATIONS SYSTEMS REQUIREMENTS

- A. Telecommunications conduits shall be installed in accordance with the requirements of ANSI/EIA/TIA 569 – Commercial Building Standard for Telecommunications Pathways and Spaces, and the Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual. Note that some of these requirements are more stringent than the National Electrical Code. Conduits shall be concealed in the requirements of the National Electrical Code.
- B. In general, the raceway size shall be determined in accordance with the following table (unless otherwise indicated on the drawings):

Conduit Trade Size (inches)	Wiremold Size	Number of Cables	
		Cable O.D. of 5.6 mm	Cable O.D. of 6.1 mm
1	V2000	7	6
1¼	V2000	12	10
1½	V2400	16	15
2	V2400	22	20

- C. There shall be no more than two (2) 90 degree bends between pull points in telecommunications conduit, without derating of the conduit capacity. For each additional 90 degree bend the conduit capacity shall be derated by 15 %, or the conduit shall be increased to the next highest trade size. Offsets shall be considered as equivalent to a 90 degree bend. Provide additional pull boxes as required to meet this requirement.

- D. Inside radius of conduit bends shall be at least six (6) times the internal diameter of the conduit for sizes up to 2 inch trade size; ten (10) times the internal diameter of the conduit for sizes larger than 2 inch trade size. Where bending machine shoes are not available with the required bending radius for a one-shot field bend, factory bent, large radius 90 degree elbows shall be provided. Conduits of all sizes for use as optical fiber raceways shall have a minimum inside bend radius of ten (10) times the internal diameter of the conduit.
- E. Conduits which are terminated at ladder-type cable trays shall be supported from structure within a maximum distance of 24 inches from the tray. Conduits terminated at cable trays shall be bonded to the tray in accordance with Section 26 05 26 – Grounding and Bonding.
- F. Conduits entering the telecommunications closet or equipment room through the floor shall be terminated 4 inches above finished floor. Conduits entering the telecommunications closet or equipment room from above shall be terminated 4 inches below the finished ceiling, but in no case shall the conduits terminate greater than 12 inches above the ladder racking or distribution frame.
- G. Conduits and cut-out openings between floors shall be sealed with firestopping material which is removable and reusable, to accommodate adds, moves, and changes in the cabling system.
- H. Layout of conduits shall give consideration to nearby sources of electromagnetic energy such as electrical power wiring, large electric motors and generators, induction heaters, variable frequency drives, etc. Maintain the greatest separation practicable between telecommunication raceways and sources of electromagnetic interference (EMI). A minimum of 5 inches of separation shall be maintained between telecommunication raceways and fluorescent lighting ballasts.
- I. Maintain minimum separation from 480 V power wiring in accordance with the following table:

Condition	Minimum Separation Distance(inches)		
	< 2 kVA	2-5 kVA	> 5 kVA
Unshielded power lines or electrical equipment in proximity to open non-metal telecommunications proximity to open non-metal telecommunications pathways	5	12	24
Unshielded power lines or electrical equipment in proximity to a grounded metal telecommunications conduit pathway	2½	6	12
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal telecommunications conduit pathway	—	3	6

3.6 SLEEVES

- A. Provide sleeves of sufficient size to permit ready installation of each conduit which passes through concrete walls or suspended slabs. Sleeves in concrete beams, joists, columns or footing walls may be installed only where permitted by the Architect.
- B. For conduit that passes through suspended concrete slabs, place sleeves with the top one inch above finished slab and the bottom flush with underside of slab. In all other cases, place sleeves with the ends flush with the concrete surfaces. Space sleeves at least three diameters apart on center or more if required by the Architect.
- C. Where conduits pass through fire resistive walls, ceilings or floors, sleeves shall be packed with fire resistive compound equal to 3M Fire Barrier.
- D. Penetrations through fire rated floors, ceilings and walls shall be sealed using an approved fire barrier sealant. Fire barrier sealants shall be a UL Rated material classified for use in through-penetration fire stop systems, and shall have ICBO, BOCAI, and SBCCI (NRB 243) approved rating per ASTM-814 (UL 1479). The sealant shall be equal to 3M CP-25 caulk, FS 195 strips and

CS 195 sheet forms or an approved equal. Acceptable manufacturers are STI, 3M, Pensil, Hilti, Dow, Fyre Putty, Hevi-Duty, Nelson, Thomas & Betts, Dow.

1. Where sleeves penetrate existing fire resistive concrete walls or floors, the annular space around the sleeve shall be filled with fire resistive intumescent compound equal to STI "Spec Seal" firestop sealant as manufactured by Specified Technologies, Inc., Somerville, New Jersey. If the annular space exceeds $\frac{3}{4}$ inch, it shall be filled instead with fire resistive grout equal to STI "Spec Seal" firestop mortar.
2. Where sleeves penetrate fire resistive sheetrock walls or ceilings or where they penetrate fire resistive suspended ceilings, the annular space around the sleeve shall be filled with fire resistive intumescent compound equal to STI "Spec Seal" firestop sealant.
3. Where sleeves pass through fire resistive walls, ceilings or floors, sleeves shall be packed with fire resistive intumescent compound equal to STI "Spec Seal" firestop putty.
4. A manufacturer's supplied installation detail shall be submitted for each type of assembly with the UL approval and limitations indicated.

3.7 SEALING OF PENETRATIONS THROUGH BELOW-GRADE EXTERIOR WALLS

- A. Openings for conduit penetrations through basement exterior concrete walls shall be core drilled and sealed around the conduit using modular mechanical type of sealing closures.
- B. The inside diameter of each wall opening shall be sized as recommended by the manufacturer to allow the proper annular space around the conduit to assure a watertight seal when the sealing closure is installed. Contractor shall determine the required inside diameter of each wall opening before ordering materials or core drilling walls.
- C. Install sealing closures in accordance with the manufacturer's instructions.

3.8 FLASHING OF ROOF CONDUIT PENETRATIONS

- A. Electrical conduits passing through the roof shall be flashed using four pound seamless lead flashing assemblies, in accordance with manufacturer's instructions for the roof system utilized.
- B. The neck of the flashing and the conduit shall be sealed with waterproofing compound as recommended by the manufacturer of the flashing assembly. The protected counterflashing shall be secured to the conduit with vandal-proof set screws. The upper annular space between the conduit and the counterflashing shall also be sealed with the recommended waterproofing compound.
- C. Install flashing assemblies in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 260531
SURFACE RACEWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Surface metal raceways
- B. Multi-outlet assemblies
- C. Wireways

1.2 RELATED SECTIONS

- A. Section 26 05 26 - Grounding and Bonding
- B. Section 26 27 26 - Wiring Devices: Receptacles
- C. Section 26 27 27 - Supporting Devices
- D. Section 27 05 28 - Telephone Service, Pathways, and Wiring

1.3 REFERENCES

- A. National Electrical Code Article 362 - Wireways, Article 374 - Auxiliary Gutters
- B. National Electrical Contractor's Association (NECA) Standard of Installation
- C. NEMA WD 6 - Wiring Device Configurations
- D. Underwriters Laboratories (UL) Standard of Safety 870 - Wireways, Auxiliary gutters and Associated Fittings

1.4 SUBMITTALS

- A. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

1.5 REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. or other testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 SURFACE METAL RACEWAY

- A. Manufacturers: Wiremold, or approved equal
- B. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- C. Size: As shown on drawings. If not shown, raceway shall be Wiremold #V3000.
- D. Finish: As selected by Architect.
- E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories.

2.2 MULTI OUTLET ASSEMBLY

- A. Manufacturers: Wiremold, or approved equal
- B. Multi outlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multi outlet assembly.

- C. Size: As indicated on drawings. If not shown, raceway shall be Wiremold #3000. Where receptacles and data/telephone outlets are indicated on the drawings, raceways shall be Wiremold 4000 series, steel raceway with internal divider.
- D. Receptacles: NEMA WD 6, type 5-20R, duplex receptacle, unless indicated otherwise.
- E. Receptacle Spacing: 24" on center or as indicated on drawings.
- F. Channel Finish: Coordinate with architect and lab planner prior to ordering.
- G. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes, and connectors.

2.3 WIREWAY

- A. Manufacturers: Square D Company Model LD SQUARE-Duct NEMA 1, or approved equal
- B. Description: General purpose, 16 gauge steel minimum, with full length removable screw cover and end caps with full gasketing as required.
- C. Knockouts: Manufacturer's standard.
- D. Size: Cross-sectional dimensions shall be eight (8) times diameter of largest conduit entering from side, with a minimum dimension of 4×4 inches, unless otherwise indicated. Length shall be as required.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- D. Wireway Supports: Provide steel channel as specified in Section 26 27 27.
- E. Close ends of wireway and unused conduit openings.
- F. Ground and bond raceway and wireway under provisions of Section 26 05 26.

END OF SECTION

SECTION 260532

BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wall and ceiling outlet boxes
- B. Pull and junction boxes
- C. Access doors

1.2 RELATED SECTIONS

- A. Division 07 - Firestopping
- B. Division 08 - Access Doors and Frames
- C. Section 26 05 30 – Conduit
- D. Section 26 27 16 - Cabinets and Enclosures
- E. Section 26 27 26 - Wiring Devices
- F. Section 27 05 28 – Telecommunication Service, Pathways and Wiring

1.3 REFERENCES

- A. NECA - Standard of Installation
- B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies
- C. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- D. NEMA OS 2 - Non-metallic Outlet Boxes, Device Boxes, Covers and Box Supports
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- F. NFPA 70 - National Electrical Code

1.4 SUBMITTALS

- A. Product Data: Provide data for wall and ceiling outlet boxes, pull, and junction boxes.
- B. Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.5 REGULATORY REQUIREMENTS

- A. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

- A. Manufacturers:
 - 1. Appleton
 - 2. Crouse Hinds
 - 3. Killark
 - 4. O Z Gedney
 - 5. Raco/Bell
 - 6. Steel City

7. Or equal.
- B. Boxes shall accommodate the devices to be installed and shall be sized as required by the applicable codes for number and size of conduits and conductors entering and leaving. Round or octagon boxes will not be permitted unless specifically called for. Boxes shall have galvanized finish.
- C. Boxes shall be of code gauge steel and provided with plaster, tile or other appropriate device rings.
- D. Outlet boxes and device boxes mounted in non-masonry walls shall be minimum 4 inches square by 1-1/2 inches deep exclusive of rings and shall be provided with covers or device rings as specified. Boxes for wall switches and data/telephone outlets shall be minimum 2 1/8 inches deep exclusive of rings. Flush boxes for data/telephone outlets shall be minimum 4 inches square by 2-1/4 inches deep exclusive of rings.
- E. Outlet boxes, telephone/data boxes, and device boxes mounted in masonry walls shall be double gang masonry boxes with a minimum depth of 2½ inches. masonry walls (exclusive of rings).
- F. Multi-gang boxes shall be one-piece. Do not use built-up boxes.
- G. Weatherproof boxes shall be non-rusting cast metal with threaded hubs. Boxes shall have screw mounted, gasketed covers. Plugs shall be installed in all unused holes.
- H. Boxes installed in masonry walls shall have tile covers.

2.2 PULL AND JUNCTION BOXES

- A. Manufacturers:
 1. Saginaw
 2. Circle AW
 3. Hoffman
 4. Rittal
 5. Or equal.
- B. Special oversized outlet boxes and junction boxes (150 cubic inches and larger) shall be code gauge steel and of the knockout type. Boxes shall have screw mounted covers unless hinged covers are indicated. Boxes shall be sized in accordance with applicable codes. Special outlet boxes shall accommodate the equipment served.
- C. In damp or wet locations sheet metal pull boxes shall be hot dipped galvanized after fabrication then finish painted with two coats of rust-resistant paint. Use covers with neoprene gaskets affixed with stainless steel screws. Seal around conduit entries with silicone based sealant.
- D. Condulettes shall not be permitted without prior authorization.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify exact locations of outlets prior to rough-in. Coordinate exact location with architect and owner.

3.2 GENERAL INSTALLATION

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Electrical boxes are shown on drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.

- D. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.
- E. Boxes shall be supported independently of the conduit system. Do not fasten boxes to ceiling support wires.
- F. All boxes shall be plumb. Supports shall be noncombustible and corrosion resistant. In suspended ceilings, bar hangers shall be used to support the boxes from the ceiling channels. Refer to architectural drawings for exact heights of outlets not specified herein or indicated on the drawings. Unused knockouts in boxes shall be left sealed.
- G. Do not mount control or disconnecting devices more than 6 feet 6 inches above finish floor.
- H. Do not locate cabinets, outlets or other apertures larger than 16 square inches in rated fire walls.
- I. Where rigid conduit or IMC enters a box, fitting or device through a knockout, double locknuts and an insulated metallic bushing shall be used. EMT shall terminate at knockouts with an insulated throat fitting and one locknut. Connectors shall be made up tight to insure electrical continuity of the raceway system.
- J. Provide all necessary supports and backing for all enclosures and equipment.
- K. Attach boxes, outlets, straps, cabinets and equipment to wood with wood or lag screws, to metal with machine screws or bolts, and to concrete with expansion anchors or self-drilling metal anchors and machine screws or bolts. Use size and number of attachments as required to support equipment weight with a safety factor of four (4) minimum.
- L. Provide access doors where boxes are not exposed or located within an accessible ceiling unless indicated to be provided under other Divisions. Access doors shall comply with Division 08.

3.3 OUTLET BOX INSTALLATION

- A. Each lighting outlet, switch, receptacle and other miscellaneous device shall be provided with a suitable box.
- B. Align adjacent wall mounted outlet boxes for receptacles, data/telephone outlets, and similar devices.
- C. Use flush mounting outlet box in finished areas.
- D. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- E. Outlet boxes installed in masonry walls shall be set deep enough to allow a masonry facing over the plaster ring to frame the opening. Center outlet in a course of masonry. Masonry boxes shall be mounted as follows:
 - 1. From floor to height of 6 feet, mount so that bottom of box rests on block joint.
 - 2. Above 6 feet, mount so that top of box rests on block joint.
- F. Do not install flush mounting box back-to-back in walls; provide minimum or 6 inches separation. Provide minimum or 24 inches separation in fire-rated assemblies and acoustic rated walls.
- G. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- H. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- J. Use adjustable steel channel fasteners for hung ceiling outlet box.
- K. Use cast outlet box in exterior locations, where exposed to the weather and wet locations.
- L. Where two or more of the same type devices occur adjacent to each other, they shall be in a gang type box with a gang type cover. Where different type devices occur adjacent to each other, space

outlet boxes so that finish plates will be spaced 1 inch apart. Where receptacles or switches are shown side by side but at different heights, they shall be centered one above the other unless noted otherwise.

- M. Unless otherwise indicated, switch boxes shall be mounted with center at 48 inches, over counter convenience outlet boxes shall be centered 8 inches above the counter top or higher as required to clear the backsplash, desk height outlet boxes shall be mounted with center at 34 inches and other convenience outlets shall be mounted with center at 18 inches above the finished floor. Outlet boxes in shop areas shall be mounted with center at 48 inches above the finished floor. Coordinate outlet locations and provide box extensions or other equipment as required where outlets occur in cabinet backs.
- N. Outlets in acoustical ceilings are to be in the center of the acoustical tile or in the center of a joint in the acoustical tile.
- O. Align all outlets horizontally or vertically for a uniform and neat appearance.

3.4 PULL AND JUNCTION BOX INSTALLATION

- A. Pull boxes and junction boxes shall be provided as indicated on the drawings and/or as required.
- B. Boxes larger than 200 cubic inches or 18 inches in any dimension shall use a screw-on cover enclosure in interior dry locations, surface-mounted cast metal box in other locations.
- C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

END OF SECTION

SECTION 260553
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates
- B. Wire and Cable Markers
- C. Pull and Junction Box Identification
- D. Device Plate Identification

1.2 RELATED SECTIONS

- A. Section 26 27 26 - Wiring Devices

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Nameplates shall be laminated phenolic plastic with lettering engraved through the outer covering.
- B. Equipment and devices noted in the nameplate legend shall be labeled with a nameplate as indicated. Nameplates shall be color coded as indicated in section 26 05 53 -2.1(C).

NAMEPLATE LEGEND		
DEVICE/ITEM TYPE	REQUIRED NAMEPLATE INFORMATION	LETTERING HEIGHT
Pushbutton Stations	Source panel name, circuit number	3/16"
Enclosed Circuit Breakers	Name of equipment served, Source panel name, circuit number, Normal or Optional Standby System	1/4"
Disconnect Switches	Name of equipment served, Source panel name, circuit number, Normal or Optional Standby System	1/4"
Motor Controllers and Control Switches & All Contactors	Name of equipment served, Source panel name, circuit number, Normal or Optional Standby System	1/4"
Variable Frequency Drives	Name of equipment served, Source panel name, circuit number, Normal or Optional Standby System	1/4"
Time Switches and similar control devices	Name of equipment served, Source panel name, circuit number, Normal or Optional Standby System	1/4"
Control Panels, Terminal Cabinets, Equipment Cabinets	Name of equipment served, Source panel name, circuit number, Normal or Optional Standby System	1/4"
Equipment Racks & Special Electrical System Components	Name of equipment served, Source panel name, circuit number, Normal or Optional Standby System	1/4"
Overcurrent Devices in Switchboards & Switchgear	Name of equipment served	1/2"

- C. Phenolic nameplates which identify electrical equipment shall be color coded based on the voltage serving the equipment as outlined in the following table. Verify color scheme with owner's representative prior to commencing.

Branch of Power / System	Plate Face Color	Plate Lettering Color
208Y/120V	Black	White
480Y/277V	Red	White

- D. All junction boxes, enclosures, gutters, outlet boxes, etc for the systems listed below shall be fully painted so as to be readily identifiable as part of the indicated system. Utilize the coloring scheme outlined in the following table. Verify color scheme with owner's representative prior to commencing.

Branch of Power / System	Color
Optional Standby System (NEC 702)	Blue
Fire Alarm	Red

- E. All conduits in the project for those systems listed in 26 05 53-2.1(D) shall be identified at intervals not to exceed 10 feet and a minimum of once in every room in which the conduit is visible, utilizing the coloring scheme described in 26 05 53-2.1(D). Verify color scheme with owner's representative prior to commencing. Conduit identification shall be achieved by spot painting, consisting of a 2" band of color encircling the entire conduit, utilizing pre-colored conduit, painting the conduit fittings or any other permanent labeling method subject to prior approval.
- F. Engraved lettering shall be filled with contrasting enamel.

2.2 WIRE AND CABLE MARKERS

- A. Manufacturers:
1. W. H. Brady Co
 2. Seton
 3. Tyton.
- B. Markers shall be cloth tape, split sleeve, or tubing type.

2.3 LABELS

- A. Labels shall be Nylon stick-on labels equal to 3M. Label shall be white with black lettering for concealed locations and clear with black lettering for exposed locations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive identification materials.

3.2 NAMEPLATE INSTALLATION

- A. Nameplates shall be securely fastened to the equipment with No. 4 Phillips, round-head, cadmium-plated, steel self-tapping screws or nickel-plated brass bolts. Engraving directly on stainless steel device plates is acceptable. Nameplates shall describe the function or use of the item.

3.3 LABEL INSTALLATION

- A. Each receptacle shall be neatly identified with a nylon stick-on label on the outside of the device plate. Labels shall indicate the panel and circuit number.
- B. Refer to Division 27 for labeling requirements at communications outlets.

3.4 WIRE IDENTIFICATION

- A. Provide wire markers on each feeder conductor in panelboards, gutters or pull box.
- B. Identify with feeder source & destination.

3.5 PULL AND JUNCTION BOX IDENTIFICATION

- A. Each pull and junction box shall be neatly identified with permanent black marker on the outside of the box (where the box is concealed) and on the inside of the box (in exposed locations). Identify each pull and junction box with a system description as follows:
 - 1. Lighting – Ltg, Panel, Ckt
 - 2. Receptacles – Rec, Panel, Ckt
 - 3. Equipment – AHU-1, Panel, Ckt
 - 4. Fire Alarm – FA, Panel, Ckt

END OF SECTION

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SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Distribution panelboards
- B. Branch circuit panelboards
- C. Additions to existing panelboards

1.2 RELATED SECTIONS

- A. Section 26 05 26 - Grounding and Bonding
- B. Section 26 05 53 - Electrical Identification
- C. Section 26 28 13 - Fuses

1.3 REFERENCES

- A. NEMA PB 1 - Panelboards
- B. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- C. UL 50 - Cabinets and Boxes
- D. UL 67 - Panelboards
- E. UL 98 - Enclosed and Dead-front Switches
- F. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
- G. UL 512 - Fuseholders
- H. UL 943 - Ground-Fault Circuit Interrupters
- I. UL 977 - Fused Power Circuit Devices

1.4 SUBMITTALS FOR REVIEW

- A. Product Data: Submit information covering every type of panelboard to be provided on the project, as follows: component list; descriptive bulletins; voltage; overcurrent device interrupting capacity ratings; conductor terminal sizes; and accessories.
- B. Shop Drawings: For each panelboard, show the following: voltage and phase; main bus ampacity; integrated short circuit ampere rating; outline and support points, with dimensions; wiring gutter dimensions; overcurrent device arrangement; overcurrent device trip ratings; location of neutral and ground buses; and wiring gutter dimensions.

1.5 PROJECT FINALIZATION

- A. Submit under provisions of Section 26 01 02.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- C. Maintenance Data: Furnish the following information: replacement parts listing, including source; recommended maintenance procedures and intervals; and a copy of NEMA Standards Publications PB1.1.

- D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with the manufacturer.

1.6 RECORD DOCUMENTS

- A. Record final location of each panelboard.
- B. Record actual circuiting arrangements.

1.7 QUALITY ASSURANCE

- A. Products: Panelboards shall be designed and manufactured in accordance with the latest revision of NEMA PB1.
- B. Installation: Panelboard installation shall conform to the latest revision of NEMA PB1.1, as applicable.

1.8 REGULATORY REQUIREMENTS

- A. Products: Panelboards and devices therein shall be UL listed and classified as suitable for the purpose indicated.

1.9 WARRANTY

- A. Submit under provisions of Section 26 01 02.
- B. Products furnished under this section shall be guaranteed against defective parts or workmanship for a period of one year after the date of substantial completion. The guarantee shall cover full parts and labor.

1.10 EXTRA PRODUCTS

- A. Furnish ten (10) panelboard keys of each type.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

- A. Manufacturers: Eaton Electrical or Square D. Provide new equipment of same manufacturer (Square D) in existing panelboards.
- B. Types: Panelboards shall be dead-front design. Panelboards shall be circuit breaker type, except where fused switch assemblies are specifically indicated.
- C. Interiors: Panelboard interiors shall be completely factory assembled with bolt-on devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
 - 1. Main bus bars shall be copper, sized to limit temperature rise on any current carrying part to a maximum of 150 °F above an ambient of 104 °F outside the enclosure.
 - 2. Full-size insulated neutral bars shall be included for panelboards indicated with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have suitable lugs for the incoming feeder and each outgoing feeder or branch circuit requiring a neutral connection.
 - 3. A copper ground bus capable of being isolated shall be included in each panelboard. The ground bus shall be bonded to panelboard enclosure, except where isolated ground bus is indicated. Ground busing shall have suitable lugs for the equipment grounding conductors associated with the incoming feeder and each outgoing feeder or branch circuit, and for any bonding conductors.
- D. Finish: In finished areas, finish all panels with one (1) coat of zinc chromate and one coat of primer sealer. In all other locations, finish panels with one (1) coat of zinc chromate and one coat of gray baked enamel.

- E. Door locks shall be Corbin. All locks shall be keyed alike with TEU-1 key number.
- F. Enclosures: Panelboard enclosures shall be NEMA Type 1 general purpose enclosures. Enclosures shall be made from galvanized steel. Provide adequate gutter space for wire bending and termination. Where feeder conductors supplying the mains of a panel board are carried through its enclosure to supply other electrical equipment, the enclosure shall be sized to include the additional required wiring space. At least four (4) interior mounting studs with adjustable nuts shall be provided.
 - 1. Panelboards shall be surface-mounted or flush-mounted as indicated. Surface trims shall be same height and width as box. Flush trims shall overlap the box by $\frac{3}{4}$ inch on all sides.
 - 2. When panelboards are located adjacent to each other, cabinets and doors shall be of the same size.
 - 3. Where barriered top, side or bottom compartments are indicated, each compartment shall have its own hinged, lockable door. Maintain at least 2 inches of solid trim between doors. Contactors or relays mounted in panelboard compartments shall have vibration isolators.
 - 4. Where skirts are indicated, provide removable sheet-metal skirts to the floor and to the ceiling to conceal conduits.
- G. Provide spare breakers and prepared space as indicated in the drawings.
- H. Service Equipment: Panelboards used as service-entrance equipment shall be UL listed and labeled as suitable for such use.

2.2 DISTRIBUTION PANELBOARDS

- A. Enclosures: Enclosures for distribution panelboards shall be at least 11 inches deep, and 36 inches wide.
 - 1. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
- B. Bolt-On Alternative: In lieu of bolt-on circuit breakers, circuit breakers equipped with line terminal jaws, equal to Square D I-Line type, are acceptable, provided that in the event of a short circuit condition, the increased magnetic flux causes the jaws to grip the bus more firmly. Circuit breaker jaws shall be protected by an impact resistant molded shroud. Circuit breakers of this type shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners.

2.3 BRANCH CIRCUIT PANELBOARDS

- A. Enclosures: Enclosures for lighting and appliance branch circuit panelboards shall be at least 5.5 inches deep and 20 inches wide.
 - 1. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles.
 - 2. Doors shall be flush with panelboard trim and shall not uncover any live parts. Doors shall have a flush cylinder lock and catch assembly. Doors over 48 inches in height shall have auxiliary fasteners.
 - 3. Door locks shall be Corbin. All locks shall be keyed alike with TEU-1 key number.
- B. Panel Index: A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

2.4 SHORT CIRCUIT RATINGS

- A. Each panelboard shall be labeled with a UL integrated equipment short circuit rating. All overcurrent protective devices shall have the interrupting capacity rating as indicated without relying upon series-connected ratings, except as otherwise specifically indicated on the drawings and/or associated schedules.
- B. Panelboards applied at 240 volts or less shall have short circuit ratings as indicated on the drawings and/or associated schedules, but not less than 10,000 amperes RMS symmetrical at 240 volts.

- C. Panelboards applied at 480 volts shall have short circuit ratings as indicated on the drawings and/or associated schedules, but not less than 14,000 amperes RMS symmetrical at 480 volts.

2.5 CIRCUIT BREAKERS

- A. Circuit breakers shall be molded-cast type, with inverse time and instantaneous tripping characteristics.
- B. Each circuit breaker shall be operated by a single toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding with arc extinction chutes. Multiple-pole circuit breakers shall be common trip.
- C. Where indicated, circuit breakers shall be current-limiting type. Such circuit breakers shall have automatically resetting current limiting elements in each pole, coordinated with the thermal and instantaneous trip elements. Let-through current and energy level shall be less than permitted for same size Class RK5 fuse.
- D. The trip rating of each circuit breaker shall be imprinted in the handle.
- E. Ground fault interrupting circuit breakers shall have "Test" button and pigtail for neutral connection.
- F. Circuit breakers located in non-air conditioned spaces or outside the building shall be ambient compensated type.
- G. Circuit breakers used for switching lighting circuits shall be UL labeled "SWD".
- H. Circuit breakers used for air conditioning equipment shall be UL labeled "HACR".
- I. Circuit breakers shall have mechanical screw type removable connector lugs, AL/CU rated.
- J. Circuit Breaker Accessories: Provide shunt-trip units and auxiliary switches as indicated on the drawings or panel schedules.

2.6 FUSIBLE SWITCH ASSEMBLIES

- A. Fusible switches shall be quick-make, quick-break, load interrupter enclosed knife switches with externally operable handles. Provide interlock with defeat mechanism to prevent opening front cover with switch in ON position. Handle shall be lockable in OFF position.
- B. Fusible switches shall be equipped with rejection-type fuse clips designed to accommodate Class R current-limiting fuses only, except as otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Field Measurement: Verify that field measurements are as indicated and that equipment will fit in the available space while maintaining required working space clearances.

3.2 DELIVERY, STORAGE AND HANDLING

- A. Inspect and report concealed damage to carrier within their required time period. Damaged equipment shall be replaced or repaired prior to installation.
- B. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.
- C. Store in a clean, dry environment. Maintain factory packaging. If required to protect equipment from dirt, water, construction debris and traffic, provide an additional heavy canvas or heavy plastic cover.

3.3 INSTALLATION

- A. Install panelboards in accordance with manufacturer's instructions.

- B. Install panelboards plumb. Recessed panelboards shall be installed flush with wall surface. Anchor panelboards to structure.
- C. Mount panelboards with top of trim 78 inches above the floor. Install panelboards taller than 78 inches with bottom no more than 4 inches above the floor. In no case shall the handle of any device be mounted more than 78 inches above the floor when in its highest position.
- D. Installation of panelboards that are flush mounted in walls shall be coordinated with other trades as required to maintain the integrity of fire-resistive walls. Where the wall is required to be fire-rated, the wall opening shall be lined with a 5/8 inch fire-rated gypsum board and all gaps shall be filled with fire-resistive intumescent sealant.
- E. Provide facilities for connection of future loads. Spare conduits shall be stubbed into the nearest accessible ceiling space or to another accessible location out of each recessed panelboard. Minimum spare conduits: Four (4) empty 3/4 inch; identify each as SPARE.
- F. Circuit breakers shall be arranged to reflect the size and order shown on the panel schedules.
- G. Provide filler plates for unused spaces in panelboards.
- H. Neatly arrange and lace conductors in panelboards, gutters and terminal cabinets by means of nylon twine or wraps.
- I. Provide a typewritten circuit directory for each branch circuit panelboard. Directory cards shall be completely filled out with all circuits adequately marked. Spares shall be marked "Spare". Directory cards shall indicate load served and room number for each circuit. The permanent room numbers, assigned by the Owner, shall be used on the directory cards. The Contractor shall verify the loads served by each existing circuit. Revise directories to reflect any circuiting changes.

3.4 ADJUSTMENT AND TESTING

- A. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's instructions.
- B. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.
- C. Measure steady state load currents at each panelboard feeder. If necessary, rearrange circuits in the panelboard to balance the phase loads to within 20 % of each other. Maintain proper phasing for multi-wire branch circuits.
- D. Upon completion of the above adjustment and testing, the Contractor shall energize the system and demonstrate proper operation of all equipment in the presence of the Owner's representative. Notify Owner's representative at least one (1) week in advance of the dates when the demonstration will be undertaken. Demonstration shall include:
 - 1. Apparatus arranged for manual operation shall be operated under power then returned to their normal position.
 - 2. Operation all control equipment and verify that it operates properly. Tests of control equipment shall include at least two operating cycles.
- E. Any deficiencies discovered as a result of the above tests shall be rectified and the work affected by such deficiencies shall be completely retested at the Contractor's expenses.
- F. Instruments, gauges, testing equipment, protective devices and safety equipment for all testing shall be provided by the Contractor. Energy for the tests will be furnished by the Owner.

3.5 TRAINING

- A. The Contractor shall provide a two (2) hour minimum of training for maintenance personnel in the maintenance and operation of the equipment. Training shall also cover maintenance and operation of other similar equipment, including enclosed circuit breakers and safety switches.

- B. A training plan shall be submitted in advance for approval, outlining the topics to be covered, the publications to be used, and the training schedule.
- C. The training shall be conducted by personnel thoroughly familiar with the equipment and its features. The training shall include instruction and over-the-shoulder hands-on training. As a minimum, the training shall cover:
 - 1. Recommended maintenance procedures and intervals.
 - 2. Operation of all control equipment to demonstrate that it operates in accordance with the requirements of this section.

END OF SECTION

SECTION 262716
CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hinged cover enclosures
- B. Cabinets
- C. Terminal blocks
- D. Accessories

1.2 RELATED SECTIONS

- A. Section 26 27 27 - Supporting Devices

1.3 REFERENCES

- A. NECA Standard of Installation (National Electrical Contractors Association)
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems
- D. NFPA 70 - National Electrical Code

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard data for enclosures, cabinets, terminal blocks, and accessories.

1.5 REGULATORY REQUIREMENTS

- A. Products: Listed and classified by Underwriters Laboratories, Inc. or other testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 CABINETS AND HINGED COVER ENCLOSURES

- A. Manufacturers:
 - 1. Circle AW
 - 2. Hoffman
 - 3. Rittal
 - 4. Or approved equal
- B. Construction: NEMA 250, Type 1 steel enclosure, unless otherwise indicated.
- C. Size: As indicated on the drawings. If not so indicated, sized to accommodate all devices within.
- D. Covers: Continuous hinge, and flush lock keyed to match branch circuit panelboard.
- E. Interior Panels: Provide 14 gauge, white enamel, and removable panels for mounting of equipment or terminal blocks.
- F. Knockouts: Manufacturer's standard knockouts.
- G. Enclosure Finish: Manufacturer's standard gray baked enamel.
- H. Provide metal barriers to form separate compartments wiring of different systems and voltages.
- I. Provide accessory feet for free-standing equipment.

2.2 TERMINAL BLOCKS

- A. Terminal Blocks: NEMA ICS 4
- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- D. Provide ground bus terminal block, with each connector bonded to enclosure.

2.3 FABRICATION

- A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.
- B. Provide conduit hubs in exterior and wet locations and knockouts in interior dry locations.
- C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout Drawing of control wiring and components within enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 26 27 27.
- C. Install cabinet fronts plumb.

3.2 CLEANING

- A. Clean electrical parts to remove conductive and harmful materials.
- B. Remove dirt and debris from enclosure.
- C. Clean finishes and touch up damage.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wall switches
- B. Receptacles
- C. Device plates and decorative box covers

1.2 RELATED SECTIONS

- A. Section 26 05 32 - Boxes

1.3 REFERENCES

- A. NECA - Standard of Installation
- B. NEMA WD 1 - General Requirements for Wiring Devices
- C. NEMA WD 6 - Wiring Device - Dimensional Requirements
- D. NFPA 70 - National Electrical Code

1.4 SUBMITTALS FOR REVIEW

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

- A. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

1.7 EXTRA MATERIALS

- A. Furnish two of each style, size, and finish wall plate.
- B. Provide two carpet rings.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. Wiring devices shall be of the same manufacturer insofar as possible. Devices shall be specification grade, switches shall be rated 20 amperes, and receptacles shall be grounding type.
- B. Devices shall be side wired only.

- C. Except as otherwise specified on the drawings, wiring devices shall be Hubbell, Pass & Seymour, Cooper, or Leviton and shall be in accordance with the following schedule:

Device	Hubbell Catalog #	Pass & Seymour Catalog #	Cooper Catalog #	Leviton Catalog #
Single Pole Switch	1221	20AC1	1221	1221-2
Single Pole Switch w/pilot light (120V)	1221-PLC	20AC1-CPL	1221ILC	1221-PLC
2-pole Switch	1222	20AC2	1222	1222-2
3-way Switch	1223	20AC3	1223	1223-2
4-way Switch	1224	20AC4	1234	1224-2
Duplex Receptacle, Standard	5252	5262	5252	5252
Duplex Receptacle, GFI	GF-5262	1591F	GF5292	6598
Duplex Receptacle, Isolated Ground	IG5252	IG6200	IG5262	5262-IG
Duplex Receptacle, Surge-Protected	IG5252-IS	G6262-ISP	IG5262S	N/A
Single Receptacle (15A, 125V)	5251	5261	5251	5251
Duplex Receptacle (20A, 125V)	5352	5362	5352	5352
Single Receptacle (20A, 125V)	5351	5361	5351	5351
Single Receptacle (30A, 125V)	9308	5920	5716N	5371
Single Receptacle (30A, 250V)	9330	5930	5700N	5372
Single Receptacle (30A, 125/250V)	9430	5744	9344N	278
Single Receptacle (50A, 250V)	9367	5950	5709N	5374
Single Receptacle (50A, 125/250V)	9450	5754	7985N	279

- D. Wiring devices shall be Grey in color for Normal power. Wiring devices served by Generator power shall be Red in color. Confirm device colors with Architect prior to ordering.
- E. Where only one receptacle, single or duplex, is supplied by a branch circuit (dedicated circuit), the receptacle shall have the same ampere rating as the overcurrent protective device ahead of the circuit.
- F. Where receptacles are provided for equipment not having grounding-type cords and cord caps, the Contractor shall furnish and install new cords and cord caps on equipment to match new receptacles.
- G. Key operated switches shall be same as above except with lock type mechanism. All switches shall use the same key.
- H. Weatherproof devices in washdown areas shall be the same as standard devices except with diecast lockable weatherproof plate equal to Intermatic #WP1000MC series cover.
- I. All other Weatherproof devices shall be the same as standard devices except with diecast lockable weatherproof plate equal to Hubbell #HBL52C22 series cover.
- J. Switch and receptacle combinations shall be devices as above in a 2-gang box.
- K. All outlets shall conform to WAC 296-46B-210-008(B)2(b). Ground fault interrupting receptacles shall be duplex type with "Test" and "Reset" buttons. Receptacle shall have feed-through

provisions for protection of downstream receptacles. Unit shall be complete with cover plate. Receptacles located on the building exterior, in toilet rooms, wet locations, and elsewhere as shown on the drawings shall be GFI type. Provide cast weatherproof cover plates with hinge on top for receptacles on the building exterior.

- L. Clock hanger outlets shall have stainless steel plate with support hook and wire well. Receptacle shall be equal to Leviton #5261-CH.

2.2 OCCUPANCY SENSORS

- A. Manufacturer: Sensor Switch or approved equal.
- B. Operating voltage shall be 24 volts D.C. Include power pack relay module with self-contained transformer and relay for derivation of operating voltage and line voltage switching. Relay contacts shall be rated for 20 amps ballast load at either 120 volts or 277 volts or 13 amps incandescent load at 120 volts.
- C. Where more than one circuit is to be switched, provide an additional slave relay module, with contacts rated the same as the power pack relay module.
- D. Occupancy sensors shall be as follows:
 - 1. Dual technology (PIR and Microphonic) ceiling sensors for up to 1000 square foot coverage shall be Sensor Switch CM Series or equal. Provide with isolated low voltage relay option for BMS interface.
 - 2. PIR extended range sensors shall be Sensor Switch CM Series or equal. Provide with isolated low voltage relay option for BMS interface.
 - 3. PIR wall switch occupancy sensors shall be Sensor Switch #WSX or equal. Provide dual relay switch where required for control of multiple zones.
 - 4. Power pack relay module shall be equal to Sensor Switch #PP20, depending on line voltage.
 - 5. Line voltage dual technology occupancy sensors with equal coverage to the above products shall be permitted where controlled loads do not exceed the occupancy sensor rating.

2.3 DEVICE PLATES

- A. Device boxes and blanked outlets shall have stainless steel plates equal to Sierra S-Line. Blank outlet plates shall be factory marked to identify the system to which it is connected. Stainless steel plates shall be 0.04 inch thick with #302 satin finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install devices plumb and level.
- B. Install switches with OFF position down.
- C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

- D. Do not share neutral conductor on load side of dimmers.
- E. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- F. Unless otherwise indicated, switches and receptacles shall be oriented vertically, except that horizontal orientation shall be permitted above counters where vertical space is constricted. Weatherproof receptacles shall be mounted horizontally with the hinge at the top.
- G. Unless otherwise indicated, switches shall be mounted with center at 48 inches above the floor. Over counter receptacles shall be mounted with center 8 inches above counter top or higher where required to clear backsplash. Unless otherwise indicated, other receptacles shall be mounted with center at 16 inches above floor. Receptacles for equipment shall be mounted at a height appropriate for connection to the equipment.
- H. Receptacles for electric water coolers shall be concealed behind the water cooler enclosure.
- I. Where vertically oriented, receptacles shall be installed with the grounding slot at the top, except above counters where the grounding slot shall be at the bottom. Where horizontally oriented, receptacles shall be installed with the grounding slot to the right.
- J. Wiring shall be connected to the side wiring terminals on wiring devices.
- K. Locate and aim occupancy sensors as required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90 % to 100 % coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The Contractor shall provide additional sensors if required to properly and completely cover the respective room.

3.4 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

- A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 262727
SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Conduit and equipment supports
- B. Anchors and fasteners

1.2 REFERENCES

- A. NECA Standard of Installation (National Electrical Contractors Association)
- B. NFPA 70 - National Electrical Code

1.3 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Section 26 01 02.
- B. Product Data: Provide manufacturer's catalog data for fastening systems.

1.4 PROJECT FINALIZATION

- A. Submit under provisions of Section 26 01 02.
- B. Operation and Maintenance Data: Include manufacturer's descriptive literature, installation instructions, maintenance and repair data, and parts listing.

1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Corrosion resistant.
- B. Select materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit, including weight of wire in conduit.
- C. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Use precast inserts, expansion anchors and preset inserts.
 - 2. Steel Structural Elements: Use beam clamps, spring steel clips, and welded fasteners.
 - 3. Concrete Surfaces: Use self drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Use expansion anchors and preset inserts.
 - 6. Sheet Metal: Use sheet metal screws.
 - 7. Wood Elements: Use wood screws.

2.2 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. B-Line or equal
- B. Description: Galvanized steel or zinc plated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
 - 1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 - 2. Do not drill or cut structural members.
 - 3. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- B. Fabricate supports from structural steel or formed steel members. Rigidly weld members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- C. Secure floor mounted equipment to floor with machine bolts and anchors in accordance with the manufacturer's recommendations and seismic requirements.
- D. Install surface-mounted cabinets and panelboards with minimum of four (4) anchors. Cabinets and panelboards shall not be secured to hollow masonry, plaster, or gypsum board partitions - provide additional blocking as required between studs to securely anchor the cabinet or panelboard.
- E. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
- F. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 262813

FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fuses for use in power distribution circuits

1.2 RELATED SECTIONS

- A. Section 26 28 16 - Safety Switches

1.3 REFERENCES

- A. NEMA FU1 - Low Voltage Cartridge Fuses
- B. UL 50 - Enclosures for Electrical Equipment
- C. UL 198C - High-Interrupting-Capacity Limiting Type Fuses
- D. UL 198D - High-Interrupting-Capacity Class K Fuses
- E. UL 198E - Class R Fuses
- F. UL 198H - Class T Fuses

1.4 SCOPE

- A. The Contractor shall provide fuses as indicated on the drawings and associated schedules.

1.5 SUBMITTALS FOR REVIEW

- A. Product Data: Submit information covering every type of fuse to be provided on the project as follows: Component list, descriptive bulletins, voltage, and interrupting capacity ratings.
- B. Shop Drawings: For each spare fuse cabinet, show the following: Outline and support points, with dimensions.

1.6 INFORMATION FOR O & M MANUAL

- A. Submittals: Information submitted for review.

1.7 RECORD DOCUMENTS

- A. Record final fuse size used for each set of fuses.

1.8 QUALITY ASSURANCE

- A. Products: Fuses shall be manufactured in accordance with the latest revision of NEMA FU1.

1.9 REGULATORY REQUIREMENTS

- A. Products: Fuses shall be UL listed and classified as suitable for the purpose indicated.

1.10 MAINTENANCE MATERIALS

- A. Provide 10 % spare fuses, but not less than three (3) of each size and type used on the project.
- B. Furnish two (2) fuse pullers of each type required to facilitate removal of fuses provided on project.

PART 2 - PRODUCTS

2.1 FUSES

- A. Manufacturers: Bussman, Shawmut, and Littlefuse.
- B. Fuses shall be provided as indicated on the drawings and shall be current-limiting type.
- C. Fuses in switchboards shall be Class L or Class J type, unless otherwise indicated on the drawings and/or associated schedules.
- D. Fuses in safety switches, busway plug-in units, and panelboards shall be Class RK1, unless otherwise indicated on the drawings and/or associated schedules.
- E. Fuses in combination motor starters and fuses protecting motors or transformers shall be Class RK5 dual-element time-delay type.
- F. Interrupting Capacity: 200,000 amperes RMS symmetrical.
- G. Provide one (1) complete set (3 per size) of spare fuses. Place spare fuses in existing spare fuse cabinet. Coordinate with Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuses in accordance with manufacturer's instructions.
- B. Install each fuse with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 262816
ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fusible switches
- B. Non-fusible switches

1.2 RELATED SECTIONS

- A. Section 26 28 13 - Fuses

1.3 REFERENCES

- A. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- B. UL 50 - Electrical Cabinets and Boxes
- C. UL 98 - Enclosed and Dead Front Switches
- D. UL 512 - Fuseholders
- E. UL 869 - Electrical Service Equipment

1.4 SCOPE

- A. The Contractor shall provide safety switches as indicated on the drawings and associated schedules.
- B. The Contractor shall adjust and test the safety switches.

1.5 SUBMITTALS FOR REVIEW

- A. Product Data: Submit information covering every type of fused switch to be provided on the project, as follows: component list; descriptive bulletins; voltage; ampere and horsepower ratings; and conductor terminal sizes.
- B. Shop Drawings: For each safety switch, show the following: outline and support points, with dimensions; location of neutral and ground buses; wiring gutter dimensions.

1.6 INFORMATION FOR O&M MANUAL

- A. Submittals: Information Submitted for Review.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protections, examination, preparation and installation of product.
- C. Maintenance Data: Furnish the following information:
 - 1. Replacement parts listing, including source.
 - 2. Recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

- A. Products: Safety switches shall be designed and manufactured in accordance with the latest revision of NEMA KS1.

1.8 REGULATORY REQUIREMENTS

- A. Products: Safety switches shall be UL listed and classified as suitable for the purpose indicated.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

- A. Manufacturers: Eaton Electrical or Square D.
- B. Type: Safety switches shall be enclosed heavy-duty type, with externally operable handle and enclosed load-interrupter knife switch.
- C. Construction: Switch mechanism shall be quick-make quick-break type, such that the operation of the contacts shall not capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
 - 1. The handle shall travel at least 90 degrees between ON and OFF positions so the handle position is easily recognizable. Facilities shall be provided for padlocking handle in OFF position.
 - 2. Switches shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the ON position.
 - 3. Switches shall have line terminal shields.
 - 4. Current carrying parts shall be plated to resist corrosion.
 - 5. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.
- D. Neutral Bus: A full-size insulated neutral bus shall be included in safety switches indicated with neutral. Neutral busing shall have suitable lugs for each incoming and outgoing circuit requiring a neutral connection.
- E. Ground Bus: A copper ground bus capable of being isolated shall be included in each safety switch. The ground bus shall be bonded to the switch enclosure, except where isolated ground bus is indicated. Ground busing shall have suitable lugs for the equipment grounding conductors associated with the incoming and outgoing circuits and for any bonding conductors.
- F. Enclosures: Rated to suit the installation location. Indoor switches shall have NEMA Type 1 general purpose enclosures, except as otherwise indicated on the drawings. Unless otherwise indicated, switches installed outdoors shall have NEMA Type 3R raintight enclosures.
 - 1. Enclosures shall be made from galvanized steel.
 - 2. Provide adequate gutter space for wire bending and termination. Where conductors supplying a safety switch are carried through its enclosure to supply other electrical equipment, the enclosure shall be sized to include the additional required wiring space.

2.2 FUSIBLE SWITCHES

- A. Fuse Clips: Fusible switches shall be equipped with rejection-type fuse clips designed to accommodate Class R current-limiting fuses only, except as otherwise indicated.
- B. Service Equipment: Fusible switches used as service-entrance equipment shall be UL listed and labeled as suitable for such use.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Field Measurement: Verify that field measurements are as indicated and that equipment will fit in the available space while maintaining required working space clearances.

3.2 DELIVERY, STORAGE AND HANDLING

- A. Inspect and report concealed damage to carrier within their required time period. Damaged equipment shall be replaced or repaired prior to installation.
- B. Handle carefully to avoid damage to safety switch internal components, enclosure, and finish.

- C. Store in a clean, dry environment. Maintain factory packaging. If required to protect equipment from dirt, water, construction debris, and traffic, provide an additional heavy canvas or heavy plastic cover.

3.3 INSTALLATION

- A. Install safety switches in accordance with manufacturer's instructions.
- B. Install safety switches plumb. Anchor safety switches to structure.
- C. Mount safety switches with top of operating handle 54 inches above floor when in its highest position, except as otherwise indicated. In no case shall the handle be mounted more than 78 inches above the floor when in its highest position.
- D. Neatly arrange and lace conductors in safety switch enclosures by means of nylon twine or wraps.
- E. Apply adhesive tag on inside door of each fusible switch indicating fuse class and size installed.

3.4 ADJUSTMENT AND TESTING

- A. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Check tightness of bolted connections using calibrated torque wrench or torque screwdriver per manufacturer's instructions.
- B. Inspect complete installation for physical damage, proper alignment, anchorage and grounding.
- C. Upon completion of the above adjustment and testing, the Contractor shall energize the system and demonstrate proper operation of all equipment in the presence of the Owner's representative. Notify Owner's representative at least one week in advance of the dates when the demonstration will be undertaken. Demonstration shall include:
 - 1. Apparatus arranged for manual operation shall be operated under power then returned to their normal position.
- D. Any deficiencies discovered as a result of the above tests shall be rectified and the work affected by such deficiencies shall be completely retested at the Contractor's expense.
- E. Instruments, gauges, testing equipment, protective devices and safety equipment for all testing shall be provided by the Contractor. Energy for the tests will be furnished by the Owner.

END OF SECTION

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SECTION 262817
ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Molded-case enclosed circuit breakers

1.2 RELATED SECTIONS

- A. Section 26 05 53 - Electrical Identification: Engraved nameplates
- B. Section 26 27 27 - Supporting Devices

1.3 REFERENCES

- A. NEMA AB1 - Molded Case Circuit Breakers
- B. UL 50 - Enclosures for Electrical Equipment
- C. UL 489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures
- D. UL 869 - Electrical Service Equipment
- E. UL 943 - Ground-Fault Circuit Interrupters

1.4 SCOPE

- A. The Contractor shall provide enclosed circuit breakers as indicated on the drawings and associated schedules.
- B. The Contractor shall adjust and test the enclosed circuit breakers.

1.5 SUBMITTALS FOR REVIEW

- A. Product Data: Submit information covering every type of enclosed circuit breaker to be provided on the project, as follows: Component list, descriptive bulletins, voltage, interrupting capacity ratings, conductor terminal sizes, trip units, if applicable, and accessories.
- B. Shop Drawings: For each enclosed circuit breaker, show the following: Outline and support points, with dimensions, location of neutral and ground buses, and wiring gutter dimensions.

1.6 PROJECT FINALIZATION

- A. Submit under provisions of Section 26 01 02.
- B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- C. As-Built Drawings: Record final location of each enclosed circuit breaker.
- D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with the manufacturer.

1.7 QUALITY ASSURANCE

- A. Products: Circuit Breakers shall be manufactured in accordance with the latest revision of NEMA AB1.

1.8 REGULATORY REQUIREMENTS

- A. Products: Enclosed circuit breakers shall be UL listed and classified as suitable for the purpose indicated.

1.9 WARRANTY

- A. Submit under provisions of Section 26 01 02.
- B. The enclosed transfer switch furnished under this section shall be guaranteed against defective parts or workmanship for a period of one year after the date of substantial completion. The guarantee shall cover full parts and labor.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

- A. Manufacturers: Eaton Electrical or Square D.
- B. Type: Enclosed circuit breakers shall be provided with dead-front enclosures. The circuit breaker handle or operating mechanism shall be accessible through the front cover.
- C. Neutral Bus: A full-size insulated neutral bar shall be included in each enclosed circuit breaker indicated with neutral. Neutral busing shall have suitable lugs for all incoming and outgoing circuits requiring a neutral connection.
- D. Ground Bus: A copper ground bus capable of being isolated shall be included in each enclosed circuit breaker. The ground bus shall be bonded to the enclosure, except where ground bus is indicated to be isolated. Ground busing shall have suitable lugs for the equipment grounding conductors associated with all incoming and outgoing circuits and for any bonding conductors.
- E. Enclosures: Enclosures shall be suitable for locations as indicated on the drawings. Except as otherwise indicated, enclosures located indoors shall be NEMA Type 1 general purpose enclosures, and enclosures located outdoors shall be NEMA Type 3R rain-tight enclosures.
 - 1. Enclosed circuit breakers shall be surface-mounted or flush-mounted as indicated. Surface trims shall be same height and width as box. Flush trims shall overlap the box by $\frac{3}{4}$ inch on all sides.
 - 2. Enclosures shall be made from galvanized steel. Provide adequate gutter space for wire bending and termination. Where conductors supplying the enclosed circuit breaker are carried through its box to supply other electrical equipment, the enclosure shall be sized to include the additional required wiring space.
- F. Finish: In finished areas, finish enclosed circuit breakers with one coat of zinc chromate and one coat of primer sealer. In all other locations, finish enclosed circuit breakers with one coat of zinc chromate and one coat of gray baked enamel.
- G. Service Equipment: Enclosed circuit breakers used as service-entrance equipment shall be UL listed and labeled as suitable for such use.

2.2 SHORT CIRCUIT RATINGS

- A. Each enclosed circuit breaker shall be labeled with a UL integrated equipment short circuit rating. All circuit breakers shall have the interrupting capacity rating as indicated without relying upon series-connected ratings, except as otherwise specifically indicated on the drawings and/or associated schedules.
- B. Enclosed circuit breakers applied at 240 volts or less shall have short circuit ratings as indicated on the drawings and/or associated schedules, but not less than 10,000 amperes RMS symmetrical.
- C. Enclosed circuit breakers applied at 480 volts or less shall have short circuit ratings as indicated on the drawings and/or associated schedules, but not less than 14,000 amperes RMS symmetrical.
- D. When series ratings are indicated on the drawings and/or associated schedules, a UL series-rating label shall be provided. The label shall state the conditions of the UL series rating, including:
 - 1. Size and type of required upstream device

2. UL series short circuit rating

2.3 CIRCUIT BREAKERS

- A. Circuit breakers shall be molded-case type, with inverse time and instantaneous tripping characteristics.
- B. Each circuit breaker shall be operated by a single toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle positions. Contacts shall be non-welding silver alloy type with arc extinction chutes. Multiple-pole circuit breakers shall be common trip.
- C. Where indicated, circuit breakers shall be current-limiting type. Such circuit breakers shall have automatically-resetting current limiting elements in each pole, coordinated with the thermal and instantaneous trip elements. Let-through current and energy level shall be less than permitted for same size Class RK-5 fuse.
- D. The trip rating of each unit shall be clearly indicated and visible or identified on a permanently affixed nameplate. Adjustments shall be accessible without removing covers, unless such removal does not require use of tools.
- E. Where indicated, circuit breakers shall be equipped with a tripping system consisting of three (3) current sensors, a trip unit, and a flux-transfer shunt trip. The trip unit shall provide adjustable time-current protection functions. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. The trip unit shall include adjustments for:
 1. Long-time pick-up and delay
 2. Short-time pick-up and delay, with I²t curve-shaping option
 3. Instantaneous pick-up
- F. The trip rating of the circuit breakers shall be imprinted in the handle.
- G. Ground fault interrupting circuit breakers shall have "Test" button and pigtail for neutral connection.
- H. Circuit breakers located in non-air conditioned spaces or outside the building shall be ambient compensated type.
- I. Circuit breakers used for switching lighting circuits shall be UL labeled "SWD".
- J. Circuit breakers used for air conditioning equipment shall be UL labeled "HACR".
- K. Circuit breakers shall have mechanical screw type removable connector lugs, AL/CU rated.

2.4 ACCESSORIES

- A. Handle Lock: Enclosed circuit breakers shall include provisions for padlocking.
- B. Provide kirk-key interlocks, shunt trips, and auxiliary switches as indicated on the drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Field Measurement: Verify that field measurements are as indicated and that the equipment will fit in the available space while maintaining required working clearances.

3.2 DELIVERY, STORAGE AND HANDLING

- A. Inspect and report concealed damage to carrier within their required time period. Damaged equipment shall be replaced or repaired prior to installation.
- B. Handle carefully to avoid damage to enclosed circuit breaker internal components, enclosure and finish.

- C. Store in a clean, dry environment. Maintain factory packaging. If required to protect equipment from dirt, water, construction debris and traffic, provide an additional heavy canvas or heavy plastic cover.

3.3 INSTALLATION

- A. Install enclosed circuit breakers in accordance with manufacturer's instructions.
- B. Install enclosed circuit breakers plumb. Recessed enclosed circuit breakers shall be installed flush with wall surface. Anchor enclosed circuit breakers to structure.
- C. Mounting Height: 60 inches to operating handle.
- D. Neatly arrange and lace conductors in enclosures by means of nylon twine or wraps.

3.4 ADJUSTMENT AND TESTING

- A. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench for torque screwdriver per manufacturer's instructions.
- B. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.
- C. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit, yet provide adequate protection from overcurrent and fault currents.
- D. Upon completion of the above adjustment, the Contractor shall energize the system and demonstrate proper operation of all equipment and materials in the presence of the Owner's representative. Notify Owner's representative at least one (1) week in advance of the dates when the above demonstration will be undertaken. Demonstration shall include:
 - 1. Apparatus arranged for manual operation shall be operated under power then returned to their normal position.
 - 2. Operate all control equipment and verify that it operates properly. Tests of control equipment shall include at least two operating cycles.
- E. Any deficiencies discovered as a result of the above tests shall be rectified and the work affected by such deficiencies shall be completely retested at the Contractor's expenses.
- F. Instruments, gauges, testing equipment, protective devices and safety equipment for all testing shall be provided by the Contractor. Energy for the tests will be furnished by the Owner.

END OF SECTION

SECTION 262913
ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Manual motor starters
- B. Automatic motor controllers
- C. Combination motor controllers and disconnects

1.2 RELATED SECTIONS

- A. Section 26 05 53 - Electrical Identification: Engraved nameplates
- B. Section 26 27 27 - Supporting Devices
- C. Section 26 28 13 - Fuses
- D. Section 26 28 17 - Enclosed Circuit Breakers

1.3 REFERENCES

- A. NEMA ICS2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC
- B. UL 98 - Enclosed Cabinets and Boxes
- C. UL 98 - Enclosed and Dead Front Switches
- D. UL 198G - Fuses for Supplementary Overcurrent Protection
- E. UL 508 - Electrical Industrial Control Equipment
- F. UL 512 - Fuseholders
- G. UL 991 - Tests for Safety Related Controls Employing Solid-State Devices

1.4 SCOPE

- A. The Contractor shall provide motor controllers for control of various equipment as indicated on the drawings, the equipment schedule, and the separate motor controller schedule. Where so indicated, controllers shall be combination fused switch disconnects and motor starters.
- B. The Contractor shall adjust and test the motor controllers and devices therein, and instruct the Owner's staff in operation and recommended maintenance procedures.

1.5 SUBMITTALS FOR REVIEW

- A. Product Data: Submit information covering every type of motor controller to be provided on the project, as follows: Component list, descriptive bulletins, voltage, ambient environment ratings, overcurrent device interrupting rating, if applicable, protection against transients and faults, if applicable, conductor terminal sizes, and accessories.
- B. Shop Drawings: For each automatic motor controller, show the following: Motor controller types, ratings, features, and accessories, front and side views of enclosures, with overall dimensions, conduit entrance locations, and equipment weight.

1.6 PROJECT FINALIZATION

- A. Submit under provisions of Section 26 01 02.

- B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, start-up and programming of product.
- C. Maintenance Data: furnish the following information: replacement parts listing, including source, recommended maintenance procedures and intervals, wiring diagrams.
- D. Test Reports:
 - 1. Indicate results of factory production tests.
 - 2. Indicate field test and inspection procedures and test results.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with the manufacturer.

1.7 QUALITY ASSURANCE

- A. Products: Motor controllers shall be designed and manufactured in accordance with the latest revision of NEMA ICS2.

1.8 REGULATORY REQUIREMENTS

- A. Products: Motor controllers and devices therein shall be UL listed and classified as suitable for the purpose indicated.

1.9 OPERATION

- A. Controls shall provide interface for manual operation and remote control. Pilot lights shall indicate motor run status. Omit remote control and pilot lights in the case of manual motor starters.
- B. When the controls call for the motor to which the controller is connected to be started, the motor controller shall accelerate the motor to full speed.
 - 1. Full speed for 2-speed controllers shall be selectable via the controls.
 - 2. Motor acceleration for solid-state reduced voltage non-reversing (RVNR) controllers shall be a smooth stepless ramp, in accordance with torque and ramp time settings. Once the motor reaches full speed, a contactor shall close in parallel to the solid-state controls to maintain motor speed until the motor is stopped.
- C. When controls call for the motor to be stopped, the motor controller shall disconnect power from the motor, causing the motor to return to rest.
- D. Motor overload protection shall be provided by solid state overload relays sized to actual motor full-load amperes.

1.10 WARRANTY

- A. Submit under provisions of Section 26 01 02.
- B. The enclosed motor controllers furnished under this section shall be guaranteed against defective parts or workmanship for a period of one (1) year after the date of substantial completion. The guarantee shall cover full parts and labor.

1.11 MAINTENANCE SERVICE

- A. Furnish a proposal to the Owner for yearly service and maintenance of solid-state reduced-voltage non-reversing (RVNR) controllers provided by the project, to take effect following expiration of the Contractor's warrantee period.

1.12 EXTRA MATERIALS

- A. Furnish one (1) set of manufacturer's instructions and maintenance data affixed to the outside of each RVNR controller.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Manufacturers: Eaton Electrical or Square D.

2.2 MANUAL MOTOR STARTERS

- A. Description: Manual motor starters shall be enclosed, general-purpose, Class A, manually operated, full-voltage controllers with toggle handles. Each manual motor starter shall include properly sized overload elements and a green neon pilot run light.
- B. Enclosures: Enclosures shall be NEMA rated to suit the installation location. Manual motor starters that are wall-mounted in finished spaces shall be equipped with flush faceplates suitable for mounting the device recessed in a standard outlet box. In mechanical rooms, above ceilings and in other unfinished locations, manual master starters shall be equipped with surface mounting enclosures.

2.3 AUTOMATIC MOTOR CONTROLLERS

- A. Description: Automatic motor controllers shall be enclosed general-purpose Class A motor starters, sized for the application. Provide control station and pilot lights in cover as indicated on separate motor controller schedule(s). Automatic controllers shall include the following features:
 - 1. Overload protection in each ungrounded conductor with a common reset button. Protection shall consist of adjustable, solid state overload relays which shall protect the motor from overload, phase loss and ground faults.
 - 2. A fused 120 volt control voltage transformer with primary and secondary fuses.
 - 3. An adjustable 0 to 30 second time delay relay.
 - 4. Pilot lights operated by dedicated auxiliary contacts, quantity as indicated.
 - 5. Buttons: Hand-Off-Auto selector switch.
 - 6. Auxiliary contacts as required for interlocks and control sequences indicated.
 - 7. Additional spare normally-open and normally-closed auxiliary contacts as indicated, but not less than two (2) per starter (one of each type).
- B. Full-Voltage Controllers: Full-Voltage Controllers shall be magnetic motor starters. Contactors shall be electrically-operated and electrically held, with arc extinguishing characteristics and silver-to-silver renewable contacts.
- C. Two-Speed Controllers: Reduced-voltage controllers shall be provided for two-speed motors. Two-speed controllers shall be magnetic starters as specified for full-voltage starters, except they shall have two contactors. Two-speed controllers shall be two winding type to control separate windings of reconnectable squirrel-cage induction motors, so as to operate motor at different speeds. Six (6) overload units shall be provided for each starter, sized for the actual full-load current of the motor at the relevant speeds.
- D. Reduced-voltage controllers shall be provided for certain motors as indicated on separate motor controller schedule(s). Each reduced-voltage non-reversing (RVNR) controller shall be a solid-state reduced voltage starter, equipped with a magnetic contactor which shall automatically bypass the solid-state controls and remove them from the circuit once the motor reaches rated voltage and speed. The solid-state controls shall utilize a six (6) silicon controlled rectifier (SCR) full-wave rectifier design and shall provide for adjustable voltage or current ramp to control starting torque. Controllers shall conform to the following requirements:
 - 1. The solid-state controls shall consist of three (3) sets of back-to-back phase-controlled power semi-conductors mounted on an electrically-isolated heat sink, together with associated logic circuitry.

2. Power semi-conductors shall be rated with peak inverse voltage at least 2.5 times rated line-to-line voltage.
 3. Suitably rated snubbers for voltage suppression shall be included to prevent false SCR firing due to dv/dt characteristics of the electrical system.
 4. Logic circuitry shall include:
 - a. Three-phase current sensing via current transformers for closed loop control to insure motor stability.
 - b. Dual inline package (DIP) switches for current limit calibration range for various motor ampere ratings.
 - c. Voltage ramp-up time adjustment: 1 to 45 seconds
 - d. Current limit adjustment: 250 to 500 %
 - e. Initial torque adjustment: 20 to 80 % of rated voltage or 100 to 200 % of rated current
 - f. Smooth stop time adjustment: 3 to 30 seconds, with an interlock to release starter seal-in lock upon completion of stop cycle.
 - g. Automatic reset upon removal of line power and re-application of incoming power. Tripped functions shall be designed to be cleared by removing control power from logic circuitry.
 - h. A stall/SCR protective circuit with inverse time characteristic and thermal memory.
 - i. Short circuit electronic trip overcurrent protection: time not to exceed ½ cycle.
 - j. Electronic running overload protection, based on inverse time-current algorithm.
 - k. Phase loss/unbalance protection: to shut down unit upon 35 % current differential between any two phases.
 - l. Gate firing circuit lockout protection on trip
 - m. Fault relay lockout protection
 - n. Minimum and maximum voltage adjustments
 - o. Voltage stability adjustment
 5. The paralleling bypass contactor shall be fully rated for across-the-line starting duty. The contactor shall utilize an energy balanced contact closure to limit contact bounce.
 6. Enclosed units shall include a thermal magnetic circuit breaker for short circuit protection and quick disconnect means. Starters and breakers are to be tested in series and be rating for UL withstand rating of 35,000 amperes RMS symmetrical, minimum.
 7. A normally open (NO) contact shall annunciate fault conditions.
- E. Enclosures: Enclosures shall be NEMA rated to suit the installation location. Unless otherwise indicated, units located indoors shall be provided with NEMA Type 1A general purpose enclosures with fully gasketed doors. Enclosures shall be constructed of sheet steel, not less than 16-gauge thick.
- F. Finish: Enclosure surfaces shall be thoroughly cleaned and phosphatized prior to painting. They shall be primed with a corrosion-resistant coating, and finished with gray baked enamel.

2.4 DISCONNECTS

- A. Combination Controllers: Where combination controllers are indicated, combine motor controllers with fusible switch disconnect or motor circuit protector in common enclosure.
- B. Fusible Switches: Fusible switches shall be quick-make quick-break, load-interrupter knife switches with externally operable handles.
1. Provide interlock with defeat mechanism to prevent opening front cover with switch in ON position.
 2. Handle shall be lockable in OFF position.
 3. Fuse clips shall be rejection-type designed to accommodate Class R current-limiting fuses only.
 4. Reference Section 26 28 16 for additional information.
- C. Motor circuit protectors shall be molded-case circuit breakers, as specified in Section 26 28 17, except that the tripping characteristic shall be magnetic-only instantaneous trip without thermal inverse-time trip.

1. Instantaneous trip setting shall be adjustable.
2. The operating handle shall have a positive, non-teasing operating mechanism mounted on the front cover, arranged for ON/OFF action. The operating handle shall have means for padlocking in the OFF position.
3. Provide current limiters in each phase, circuited in with the motor circuit protector. The current limiters shall be specifically designed for motor circuits. Current limiters shall be coordinated with the motor circuit protector to allow the motor circuit protector to clear low-level faults, and prevent single-phasing should the current limiter operate. Each phase of the current limiter shall have a built-in trip indicator.
4. A manual push-to-trip button shall be provided to exercise trip unit.

2.5 ACCESSORIES

- A. Pilot Lights: Heavy duty oil tight type, mounted in cover.
- B. Pilot Light Contacts: Form Z
- C. Auxiliary Contacts: Field convertible contacts, in addition to seal-in contact and pilot light contacts.
- D. Hand-Off-Auto Selector Switches: Rotary type, mounted in cover.
- E. Indicators: Light-emitting diode (LED) lamps, liquid-crystal display (LCD) read-outs or dial gauges.
- F. Relays: 120 volt, unless otherwise indicated.
- G. Control Power Transformers: 120 volt secondary, sized for control burden plus 50 %, 100 VA minimum. Provide fused primary and secondary, and bond unfused leg of secondary to enclosure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Field Measurement: Verify that field measurements are as indicated, and that equipment will fit in the available space while maintaining required working space clearances.

3.2 FACTORY TESTING

- A. The following factory production tests shall be performed on each automatic motor controller:
 1. Printed circuit boards, if applicable, shall be tested under a temperature cycling 32 °F to 150 °F twenty-four (24) hour load test and then functionally tested via fault finder bench equipment prior to unit installation.
 2. Final assembly shall be tested at full load with application of line-to-line and line-to-ground bolted faults. The overcurrent protective device shall trip without device failure.
 3. After the above tests have been performed, each controller shall undergo a twelve (12) hour burn-in test. The controller shall operate at 100 % inductive or motor load for twelve (12) hours without an unscheduled shutdown.
 4. After the above tests, each controller shall be thoroughly tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment.
 5. Each RVNR unit shall be factory pre-set to operate the type of load to which it is to be connected under the most common application conditions.
- B. Each controller shall be thoroughly inspected prior to packaging and shipping.
- C. The manufacturer shall furnish three (3) certified copies of the factory production test report, which shall be included in the O&M Manuals.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products in conformance with manufacturer's recommended practices.

- B. Inspect and report concealed damage to carrier within their required time period. Damaged equipment shall be replaced or repaired prior to installation.
- C. Store in a clean, dry environment. Maintain factory wrapping. If required to protect equipment from dirt, water, construction debris and traffic, provide an additional heavy canvas or heavy plastic cover.
- D. Handle carefully to avoid damage to motor controller internal components, enclosure and finish.

3.4 INSTALLATION

- A. Install motor controllers in accordance with manufacturer's written instructions.
- B. Install motor controllers plumb. Anchor to structure.
- C. Mount motor controllers in locations indicated. If location is not indicated, mount adjacent to equipment to be controlled. Coordinate installation with equipment supplier.
- D. Mounting Height: Coordinate mounting height with the supplier of the equipment to be controlled. Where possible, mount controller such that the highest part requiring manual operation is no more than 54 inches above the floor.
- E. Connect time delay relays.
- F. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- G. Neatly arrange and support conductors using nylon tie or wraps, in accordance with the equipment manufacturer's recommendations.
- H. Provide all necessary control wiring within the motor controller. Obtain wiring diagrams for the equipment as furnished.
- I. Connect the unfused leg of each control power transformer to ground.
- J. Install fuses.
- K. Motor data: Provide a typed directory card inside the front cover of each motor controller identifying the motor served, together with its nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place each card in a clear plastic holder.

3.5 ADJUSTMENT AND TESTING

- A. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Check tightness of connections using calibrated torque wrench per manufacturer's instructions.
- B. Inspect completed installation for physical damage, proper alignment, anchorage and grounding.
- C. Adjust operating mechanisms for free mechanical movement.
- D. After installation of motor controllers, but prior to energization, pretest all components. Check operability of all controls, verify phase rotation, check interlocks, and verify output signals.
- E. Set time delay relays to stagger start the motors. Time delays for motors connected to emergency power shall be adjusted in accordance with starting sequence indicated for the emergency power system.
- F. Final connections to solid-state reduced-voltage non-reversing (RVNR) equipment shall be supervised by a trained manufacturer's representative. The manufacturer's representative shall program RVNR equipment and shall perform initial selection of user-programmable options in accordance with the Owner's direction, and in coordination with temperature control system requirements.
- G. Upon completion of the above adjustment and testing, the Contractor shall energize the system and demonstrate proper operation of all equipment in the presence of the Owner's representative.

Notify Owner's representative at least one (1) week in advance of the dates when the demonstration will be undertaken. Demonstration shall include:

1. Apparatus arranged for manual operation shall be operated under power then returned to their normal position.
 2. Operate all control equipment and verify that it operates in accordance with the requirements of this section. Tests of control equipment shall include at least two operating cycles.
 3. Field test applicable RVNR features for proper functioning. Tests shall be conducted under the supervision of the manufacturer's representative.
- H. Any deficiencies discovered as a result of the above tests shall be rectified and the work affected by such deficiencies shall be completely retested at the Contractor's expense.
- I. Instruments, gauges, testing equipment, protective devices and safety equipment for testing shall be provided by the Contractor. Energy for the tests will be furnished by the Owner.
- J. Test results and final settings shall be recorded and included in the O&M Manuals.

3.6 TRAINING

- A. The Contractor shall provide two (2) hours of training for maintenance personnel in the maintenance and operation of the equipment.
- B. A training plan shall be submitted in advance for approval, outlining the topics to be covered, the publications to be used, and the training schedule.
- C. The training shall be conducted by personnel thoroughly familiar with the equipment and its features. The training shall include instruction and over-the-shoulder hands-on training. As a minimum the training shall cover:
1. Recommended maintenance procedures and intervals
 2. Operation of all control equipment to demonstrate that it operates in accordance with the requirements of this section
 3. Demonstration of programming and control options for all programmable equipment
 4. Troubleshooting
- D. A trained manufacturer's representative shall conduct the training.
- E. After completion of the training, the manufacturer's representative shall reprogram all programmable equipment as directed by the Owner.

END OF SECTION

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